Determination of photolytic degradation of Adelax tablet (Flupentixol Dihydrochloride 0.5mg BP & Melitracen Hydrochloride10 mg INN)

The thesis entitled **"Determination of photolytic degradation of Adelax tablet (Flupentixol Dihydrochloride 0.5mg BP & Melitracen Hydrochloride 10mg INN)"** submitted to the Department of Pharmacy, East West University in the partial fulfillment of the requirement for the award of the degree of Bachelor of Pharmacy.

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In The Name of Allah (SWT) the Most Mercifull,

the Most Beneficient.

Dedication

This Paper Is Dedicated To

My Parents

Declaration by the Research candidate

I, Ikhtiar Ahmed, hereby declare that the dissertation entitled **"Determination of photolytic degradation of Adelax tablet (Flupentixol Dihydrochloride 0.5mg BP & Melitracen Hydrochloride10 mg INN)",** submitted by me to the Department of Pharmacy, East West University, in the partial fulfillment of the requirement for the award of the degree of Bachelor of Pharmacy (Honors) is a genuine & authentic record of original research work carried out by me during 2011-2012 under the supervision and guidance of Mr. Anisur Rahman Lecturer, Department of Pharmacy East West University and it has not formed the basis for the award of any other Degree/Diploma/Fellowship or other similar title to any candidate of any University.

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Thesis Certificate

This is certify that the thesis entitled **"Determination of photolytic degradation of Flupentixol-Melitracen combination products"** submitted by me to the Department of Pharmacy, East West University, and in the partial fulfillment of the requirement for the award of the degree of Bachelor of Pharmacy (B. Pharm) is a genuine & authentic record of original research work carried out by **Ikhtiar Ahmed (2008-1-70-070)** during the period 2011-2012 of his research in the Department of Pharmacy at East West University, under the supervision and guidance of me and the thesis has not formed the basis for the award of any other Degree/Diploma/Fellowship or other similar title to any candidate of any University.

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Acknowledgement

All praise be to Allah

I express my gratitude to Almighty Allah for giving me the strength, energy and patients to carry out this research work.

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GLOSSARY & ACRONYMS

B.P.: British Pharmacopoeia

Control Sample: Which tablets we were not exposed to light.

HPLC: High-Performance Liquid Chromatography

HPTLC: High-Performance Thin-Layer Chromatography

LC-MS-MS: Liquid Chromatography–Tandem Mass Spectrometry

LC-ESI-MS: Liquid Chromatography-Electrospray Ionization Mass

MAOIs: Monoamine Oxidase Inhibitors

RP-HPLC: Reverse Phase High-Performance Liquid Chromatography

TCAs: Tricyclic antidepressants

U.S.P.: United State Pharmacopoeia

UV- Spectroscopy: Ultraviolet–Visible Spectroscopy

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ABSTRACT

In this experiment we find out the photolytic effect on Flupentixol dihydrochloride and Melitracen hydrochloride combination drug. We conduct several tests to observe the effect and compare the sample after light exposure in various conditions with the control tablets which were not exposed to light. We determine the concentration (mg/ml) or potency from the absorbance of each samples. It was found that the concentration (mg/ml) or potency of Flupentixol dihydrochloride and Melitracen hydrochloride gradually decreased due to the exposure of light.

Keywords: Color Observation Test, Weight Variation Test, Thickness Test, Friability Test, Hardness Test, Potency Test in the UV- Spectroscopy.

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Chapter One

INTRODUCTION

1.1 Flupentixol-Melitracen combination

Flupentixol-Melitracen is a combination preparation of two well known and time tested molecules: flupentixol - a neuroleptic with anxiolytic and antidepressant properties of its own when given in small doses, and melitracen - a TCA with anxiolytic properties. Flupentixol-Melitracen combination contain Flupentixol 0.5 mg as Dihydrochloride and Melitracen 10 mg as hydrochloride. (MIMS 2012) In combination, the compounds Flupentixol-Melitracen exert antidepressant and anxiolytic properties. (ACI 2012)

1.2 Flupentixol Dihydrochloride

Molecular Formula $C_{23}H_{25}F_3N_2OS$, 2HCl. Flupentixol Dihydrochloride is white or almost white powder and chemically it is known as2-[4-[3-[(*EZ*)-2-(trifluoromethyl)-9*H*-thioxanthen-9-ylidene] propyl] piperazin-1-yl] ethanoldihydrochloride. Its' molecular weight is 507.44. It is very soluble in water, soluble in alcohol, and practically insoluble in methylene chloride. (British pharmacopoeia 2009)

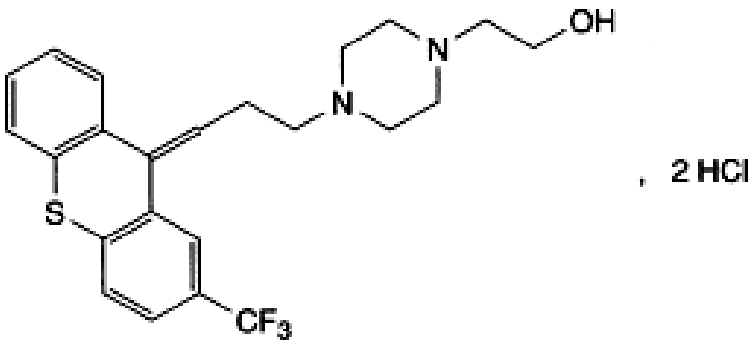

Figure1. 1: Molecular Structure of Flupentixol Dihydrochloride

1.3 Melitracen hydrochloride

Molecular Formula of Melitracen hydrochloride is $C_{21}H_{25}N.HCl$. Melitracen hydrochloride is a white to off white powder and amorphous in nature and chemically it is 3-[10, 10-Dimethyl-9(10H)-anthrylidene]-N, N-dimethylpropylamine hydrochloride. Its molecular weight is 327.90 (Chemblink 2012)

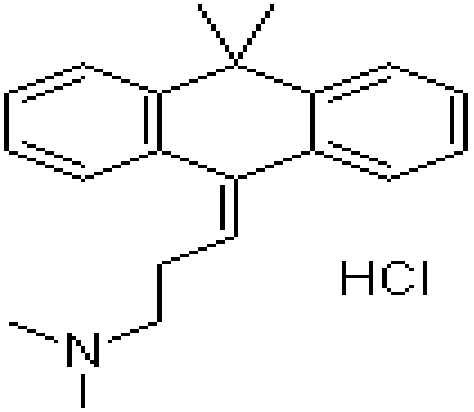

Figure 1.2: Molecular Structure of Melitracen hydrochloride

Melitracen hydrochloride is a Tricyclic Antidepressant. Thus it works by inhibiting the uptake of neurotransmitters norepinephrine and serotonin by neurons.

Flupentixol hydrochloride acts by blocking the dopamine (a neurotransmitter) receptors in brain cells. Excess amount of dopamine receptors normally act to modify behavior and overstimulation resulting in psychotic illness. Flupentixol blocks these receptors to control psychotic illness. Thus it is neuroleptic with anxiolytic and antidepressant properties. The combination of Flupentixol and Melitracen is indicated in the treatment of trigeminal neuralgia. (Yaacob 1985)

1.4 Indications

Flupentixol-Melitracen combination is indicated for the treatment of different types of anxiety, depression and apathy. These include:

Psychogenic depression

Depressive neuroses

Masked depression

Psychosomatic affections accompanied by anxiety and apathy

Menopausal depressions

Dysphoria and depression in alcoholics and drug addicts

Flupentixol-Melitracen combination is also indicated for maintenance in psychogenic depressions and other psychoses.

1.5 Dosage

Adults: Usually 2 tablets daily: morning and noon. In severe cases the morning dose may be increased to 2 tablets. Not to exceed 4 tablets daily.

Elderly patients: 1 tablet in the morning. Maintenance dose: Usually 1 tablet in the morning. In case of insomnia and severe restlessness additional treatment with sedative in the acute phase is recommended. (ACI 2012)

1.6 Adverse Drug Reactions

Drowsiness, dry mouth, constipation, vomiting, dyspepsia, diarrhea, abdominal pain, nausea, flatulence. Extra pyramidal effects, especially in the initial phase of the treatment. Tachycardia, palpitations, hypotension, thrombocytopenia, neutropenia, leukopenia. Dyspnoea, myalgia, muscle rigidity, urinary retention. Increased appetite and weight Abnormal glucose tolerance. Insomnia, depression, nervousness, agitation. (MIMS 2012)

1.7 Contra-indications

Flupentixol-Melitracen combination is not recommended for excitable or over reactive since its activating effect may lead to exaggeration of these characteristics. It should not be given to patients who have received a MAO-inhibitor within two weeks. Contraindication in the patients who have the immediate recovery phase after myocardial infarction, defects in

bundle-branch conduction, untreated narrow angle glaucoma, acute alcohol, barbiturate and opiate intoxications. (ACI 2012)

1.8 Drug Interactions

Increased risk of adverse effects when used with alcohol. May potentiate the effects of general anesthetics and anticoagulants, and prolong the action of neuromuscular blockers. May increase anticholinergic effects of atropine and drugs with anticholinergic activity. May increase risk of neurotoxicity when used with sibutramine or lithium. Concurrent usage with drugs that cause cardiac arrhythmias must be avoided. May inhibit metabolism of TCAs. May antagonize effects of adrenaline and sympathomimetics, and reverse antihypertensive effects of guanethidine. (MIMS 2012)

1.9 Precautions

Flupentixol-Melitracen combination is unsafe in porphyria. Caution must be taken when used in patients with epilepsy; Parkinson's disease; narrow angle glaucoma; prostatic hypertrophy; hypothyroidism; hyperthyroidism; liver disease; cardiac disease or arrhythmias; severe respiratory disease; renal failure; myasthenia gravis; phaeochromocytoma. Patients with hypersensitivity to thioxanthenes or other antipsychotics. Close monitoring for changes in behavior, suicidal thoughts or clinical worsening during the initial part of the treatment is recommended. May impair control of diabetes; monitor blood glucose in diabetics. (MIMS 2012).

If previously the patient has been treated with tranquilizers with sedative effect these should be withdrawn gradually.

Use in pregnancy and lactation: Flupentixol-melitracen combination should preferably not be given during pregnancy and lactation. (ACI 2011)

1.9 Overall Objectives Of The Research

The objective of this research is to determine the light sensitivity of the combination of Flupentixol dihydrochloride and Melitracen hydrochloride and to prove that the potency of this combination tablet decreased gradually on light exposure.

Chapter Two

LITERATURE REVIEW

2.1 Chronological effort done on Flupentixol & Melitracen

Flupentixol-Melitracen is combination preparation having neuroleptic with anxiolytic and antidepressant properties. Various scientific researches have been done on this drug such as:

In 1990 Thoma & Von Stein demonstrated that the rate of disaggregation is markedly influenced by the chemical structure of drugs and they find the effect of changing the association properties such as chemical structure as well as environmental conditions of psycho pharmaceuticals in colloidal solutions on their liberation by the elevation of critical micelle formation concentration and reduction of micelle weight with hydrotropic material. For example they show that the micelle weight of Flupentixol di hydrochloride reduces for about 17 per cent by concentrations of 0.2 mol/l nicotinamide or 1 mol/l propandiol-1.2, but the critical micelle concentration increases to the 3.6- and 1.4fold value (Thoma & Von Stein, 1990).

After that in 1997 Tanaka et al. done forensic analysis of eleven cyclic antidepressants including melitracen in human biological samples by using a new reversed-phase chromatographic column and showed that the ODS column packing with a particle size of 2 μm gives higher sensitivity and a shorter analysis time than the conventional ODS column packing when applied to the analysis of biological samples (Tanaka et al. 1997).

Then one year later Walter et al. developed a high-performance liquid chromatography (HPLC) method for quantification of the thioxanthene neuroleptic flupentixol and the butyrophenone derivative haloperidol (Walter et al.1998).

In the year 2000 McCLean, Kane, and Smyth done the electro spray ionization-mass spectrometric characterization of flupentixol and other anti-psychotic drugs from hair sample by using a validated (LC)-MS-MS method (McClean, Kane, and Smyth2000). The detection and determination of flupentixol and other anti-psychotic drugs is done in this method.

Then after several years in 2002 Weinmann et al. also analyzed the Hair samples of psychiatric patients by liquid chromatography–tandem mass spectrometry (LC–MS–MS) for the neuroleptics(Clozapine, Flupentixol, Haloperidol, Penfluridol, Thioridazine,and Zuclopenthixol). In this study, neuroleptics were administered to the patients regularly for a minimum of six months (Weinmann et al. 2002).

In 2002, Saldaña et al. developed a method for quality control of drugs containing tricyclic antidepressants which is known as micellar liquid chromatographic method. They showed that the UV detection was rapid and reproducible by using mobile phases which contains low organic solvent and the micellar liquid chromatography is better for determination highly hydrophobic compounds such as Tricyclic antidepressants (Saldaña et al. 2002).

On that year for the management of acute intoxication 4 anti-psychotic drugs (clozapine, loxapine, zuclopenthixol and flupentixol) Romiguieres et al. had done simultaneous determination by high performance liquid chromatography. In this method the drugs were extracted from human plasma by using liquid-liquid procedure. It is an isocratic and rapid method (run time<10 min) (Romiguiereset et al. 2002).

On that year Sheikh, Charde, and Kasture also developed absorbance ratio method for simultaneous estimation of Flupentixol-Melitracen Hydrochloride in their combined dosage form. This is a simple, sensitive and specific spectrophotometric analytical method and they showed that the result of this method lies within the prescribe limit of 98-102% (Sheikh, Charde, and Kasture 2002).

Then in 2005, by using HPLC-DAD as monitoring system a solid phase extraction method was developed by Wille et al for thirteen new generation antidepressants including melitracen and their active metabolites (Wille et al. 2005).

Then one year later by using LC/MS with sonic spray ionization (SSI) method solid-phase extraction and analysis of twenty antidepressant drugs including melitracen in human plasma was developed by Shinozuka, Terada, and Tanaka (Shinozuka, Terada, and Tanaka 2006).

On that year Kirchherr and Kühn-Velten used multi-level, single-sample approach to do quantitative determination in human serum by HPLC of forty-eight antidepressants and antipsychotics including flupentixol (Kirchherr and Velten, 2006).

In 2007 Roman et al. done quantitation of seven low-dosage antipsychotic drugs in human blood including flupenthixol by using LC-MS-MS in Postmortem. They studied on Antipsychotic drugs that are mainly involved in intoxications and suicides. On their study a few intoxications were identified from 54 authentic samples. They showed that antipsychotic drugs must be measured not only in toxic concentrations but also in therapeutic levels in postmortem cases (Roman et al. 2007).

Then in 2007 Che et al developed and validated a sensitive method by using LC/ESI-MS/MS, for simultaneous quantitation of flupentixol and melitracen—antidepressant drugs, in human plasma, that was determined in a positive ion mode and multiple reaction monitoring. It was a repeated liquid–liquid extraction process with diethyl ether (Che et al. 2007).

In 2008 for the determination of melitracen in human plasma Xu et al. substantiate liquid–liquid extraction and LC–ESI–MS method. This study is done on the 18 healthy Chinese male volunteers and it is suitable bioequivalence test of melitracen. (Xu et al. 2008).

On that year Wille did her thesis on Quantitative analysis of new generation antidepressants using gas chromatography-mass spectrometry applications in clinical and forensic toxicology (Wille, 2008).

After one year Sheikh et al. have developed a simple and selective reverse phase HPLC method for estimation of Flupentixol Hydrochloride in pharmaceutical dosage forms and validated this in terms of accuracy, precision, linearity, limit of quantization, limit of detection and solution stability (Sheikh et al. 2009).

On that year Zuo et al. developed the LC–ESI–MS fortitude method for Flupentixol in Human Plasma (Zuo et al.2009).

Later, after one year in 2010 Spectrophotometric methods were developed by Acharjya et al. for simultaneous estimation of combined tablet dosage form of Flupentixol Dihydrochloride and Melitracen Hydrochloride (Acharjya et al 2010).

On that year Maquille et al. proposed the main probable structures of flupentixol for the photolytic effect. They detect nine photoproducts by doing the photo degradation test of flupentixol in aqueous solution (Maquille et al. 2010).

On that year Ying et al. developed an eminence index assessment method for feature analysis of flupentixol and melitracen tablets. It provides very effective and useful suggestions for the production and quality inspection (ying et al. 2010).

On that year, by using Niacinamide as hydrotropic solubilizing agent Sharma et al. developed a cost effective spectrophotometric method for Melitracen Hydrochloride tablet dosage form (Sharma et al. 2010).

On that same year the year of 2010, Nagar et al. developed analytical method by using RP-HPLC for instantaneous assessment of Melitracen and Flupentixol from their pharmaceutical dosage forms. They showed that excipients used on that formulation were not intrusive in this method (Nagar et al. 2010).

Then after one year later, at 2011 for the quantitative estimation of Flupentixol in bulk and pharmaceutical dosage form Laxminarayana developed five sensitive and specific methods

(Zero order, First order, second order derivative Spectroscopy, RP-HPLC and HPTLC) (Laxminarayana, 2011).

On that year Usmangani et al developed Liquid Chromatography method for the concurrent fortitude of antidepressant drug combination Melitracen Hydrochloride and Flupentixol Dihydrochloride in their collective dosage (Usmangani et al. 2011).

On that year a simple UV Spectrophotometric method was developed by Yunus et al. for the determination of Flupentixol Dihydrochloride in bulk and pharmaceutical formulations. (Yunus et al. 2011).

On that year Elbary et al. find out the proper masking material with rapid disintegration time on in vitro and in vivo, and also the wetting time and dissolution time, hardness, drug content, friability, of compressed tablets (Elbary et al.2011).

Chapter Three

MATERIALS

&

METHOD

3.1 MATERIALS

3.1.1 Sample Collection:

500 tablets of flupentixol-melitracen a combined drug (Adelax, manufactured by ACI pharmaceutical) of same batch, were collected from the local pharmacy shop in Dhaka as a sample.

3.1.2 Samples:

Table 3.1.1

Samples used in the experiment including source

Materials Name	Source (Supplier Name)
Adelax tablet (Flupentixol Dihydrochloride 0.5mg BP & Melitracen Hydrochloride10 mg INN)	ACI Pharmaceutical Ltd.

3.1.3 Reagents:

Table 3.1.2

Reagents used in the experiment including source

Reagents Name	Source (Supplier Name)
Concentrated Sulfuric acid	Germany
Distilled Water	Laboratory (East West University)

3.1.4 Equipments & Instruments:

Table 3.1.3

Lists of equipments used for the experiment

Serial No.	Equipments	Source (Supplier Name)	Origin
1	Vernier Caliper	China Supplier	Shanghai,China
2	UV-Spectrophotometer	Shimadzu UV-1800	Japan
3	Distill Water Plant	SMIC	China
4	Electronic Balance	Precisa XB120A	Switzerland
5	Friability tester	Veegoindia	India
6	Hardness tester	Manually operated hardness tester	India

Figure 3.1.1: [Left to right] Vernier Caliper**,** Shimadzu UV-1800 Double Beam Spectrophotometer**,** Distilled water Plant

Figure 3.1.2: [Left to right] Hardness Tester, Electronic Balance, Friability tester

3.1.5 Apparatus:

Following is the list of apparatus that we used throughout the experiment.

Table 3.1.4

List of Apparatus used throughout this project

Serial No.	Apparatus
1	Forceps
2	Funnel
3	Beakers
4	Spatula
5	Glass Rod
6	Filter Papers
7	Aluminum foil paper
8	Transparent plastic paper
9	Plastic Containers
10	Mortar & Pastels
11	Test tubes
12	Volumetric Flasks (50 ml & 100 ml)
13	Pipette pumper
14	Pipette
15	Volumetric Pipette
16	Thermometer

3.2 METHODS

3.2.1 STANDARD CURVE AND EQUATION DERIVATION

The standard curve was prepared to compare the test result with it to determine the degradation of the drug. For standard curve preparation the average weight of 5 tablets were taken and all the 5 tablets was crashed by using mortar and pestle.

The average weight of the 5 tablets which was previously measured was weight from the crashed powder tablets. After measuring the powder drugs by the help of a balance, it was left to dissolve in 100ml of 0.1N H_2SO_4 solvent.

Series of dilution was carried out with the standard stock solution by pipetting 2 ml of the stock solution in test tube (1) and adding 8 ml of solvent to it. Then again pipetting 2 ml solution from test tube (1) to test tube (2) and adding 8 ml solvent to it. This was continued for more 3 times. Thus producing a known concentration of Flupentixol dihydrochloride:

Table 3.2.1

Concentration of Flupentixol dihydrochloride

Serial No.	Concentration (mg/ml)
1	0.01
2	0.002
3	0.0004
4	0.00008
5	0.000016

Following is the Concentration of Melitracen hydrochloride

Table 3.2.2

Concentration of Melitracen hydrochloride

Serial No.	Concentration (mg/ml)
1	0.2

2	0.04
3	0.008
4	0.0016
5	0.00032

Absorbance of the above solutions were taken to 229 nm wavelength for Flupentixol dihydrochloride and 258 nm wavelength for Melitracen hydrochloride in UV-Spectrophotometer and the observed value was plotted against concentration and a linear regression equation was obtained.

3.2.2 SAMPLE COLLECTION:

To determine the photo stability of the drug the tablets were subjected to various types of photo exposure, which are:

- Electric Bulb exposure (25 watts, 40 watts)
- Sunlight exposure(summer)
- Exposure to normal room temperature (14 days, 28 days, 35 days, 45 days)

3.2.2.1 Electric Bulb exposure (25 watts, 40 watts):

Two power ranges of bulb, 25 watts and 40 watts were used as the artificial light source. Thirty tablets were kept on a solid surface and were placed under 25 watts containing lamp. A thermometer was kept behind the tablets submerge in a glass of water to measure the temperature. We kept the tablets for nine hour and after each three hour 10 tablet were collected. In three hour 10 tablets where collected as 3 hour exposed sample and with more 3 hour the 6 hour exposed sample and finally with addition of more 3 hour the 9 hour sample was collected. After the sample collection analysis of the sample was conducted by measuring some physical parameters and UV visible spectroscopy to determine the potency of the drug.

3.2.2.2 Sunlight exposure:

For Sunlight exposed sample the tablets were exposed to the summer sun. Thirty tablets were kept on a paper with a thermometer for the sun exposure. In three hour 10 tablets where collected as 3 hour exposed sample and with more 3 hour the 6 hour exposed sample and finally with addition of more 3 hour the 9 hour sample was collected. Each sample containing 10 tablets.

3.2.2.3 Exposure to normal room temperature:

The exposure of the tablets was done in normal room temperature. Hundred tablets were kept in the normal room temperature in a plastic transparent container. We rapped the container with transparent plastic paper so that moisture and air cannot enter to the container. We started the preservation of the tablets in the box on 23rd February 2012.

We fixed our observation date after 14 days, 28 days, 35 days, 45 days and each time we took out 10 tablets from the container. After the sample collection analysis of the sample was conducted by measuring some physical parameters and UV visible spectroscopy to determine the potency of the drug.

3.2.2.4 Sample analysis:

After the collection of the sample it was time to proceed to the analysis step. At first the average weight of the three sample tablets were taken by the electronic balance. Then the tablets were crashed to fine powder by the help of mortar and pestle. The average weight that was previously accounted was then weighted from the crashed powdered sample and was allowed to dissolve into 100ml of 0.1N H_2SO_4 in a 100 ml volumetric flask. The solution of the volumetric flask was then filtered thought a filter paper and 10 ml of the filtrate was pipetted to a 100ml volumetric.

After all that, the sample solution was prepared for the potency test using UV-Spectroscopy. For that, each of the tests was run against a blank, and for the test the test solution was poured into the quartz cell. The quartz cell was then placed into the holder situated inside the machine. Using a specified softwere technology the absorbance of the sample solution was established in the computer.

3.2.3 PHYSICAL PARAMETERS DETERMINATION:

3.2.3.1 Color Test:

We observed the color of tablets to find any change in color. We used a digital camera to take the picture of the tablets for the comparative observation. In case of taking picture we did not use flash. We maintain a fixed camera with fixed resolution.

3.2.3.2 Weight Variation Test:

Weight variation test is most significant because it has a relationship with content uniformity of a solid dosage forms. We observe that whether the effect of light make any change in weight of tablet. whether the effect of light make any change in weight of tablet and we accept the result if no more that 2 tablets are outside the percentage limit and if no tablet differs by more than 2 times the percentage limit according to United State pharmacopoeia.

3.2.3.2.1 Procedure:

1. 10 tablets were taken and weighed all the tablets
2. The average was taken and it was considered as the standard weight of an individual tablet
3. All the tablets were weighed individually and observed whether the individual tablets are within the range or not.

The variation from the average weight in the weights not more than two tablets must not differ more than the percentage listed below:

Table 3.2.3

Accepted percentage list for the weight variation test of tablets

Weight of tablet	Percentage difference
130 mg or less	±10%
More than 130 to 324 mg	±7.5%
More than 324 mg	±5%

3.2.3.2.2 Calculation:

We used following equation to determined % Weight Variation of tablets

% Weight Variation = (A~I/I) ×100.

Where,

Initial Weight of Tablet, I (gm)

Average weight of Tablet, A (gm)

3.2.3.3 Thickness test:

The thickness test was carried out to measure the thickness of the sample tablet, to determine the deviation of the tablet thickness due to the exposure of the light. It was done by using a Vernier caliper.

3.2.3.3.1 Procedure:

1. First placing the tablet between the two jaws of the Vernier caliper.
2. Then, the main scale reading was taken.
3. The Vernier scale was taken also.
4. The two reading was added together by multiplying with the Vernier constant.

3.2.3.3.2 Calculation:

We used following formula to determined thickness of the tablets.

Thickness of the table = reading of cm scale + reading of Vernier scale + Vernier error

3.2.3.4 Hardness Test of Tablets:

Tablet hardness is usually expressed as the load required crushing a tablet placed on its edge. Hardness is thus sometimes termed the tablet crushing strength. The suitability of a tablet in regard to mechanical stability during packaging and shipment can usually be predicted on the basis of hardness. Tablet hardness, in turn, influences tablet density and porosity. It may affect tablet friability and disintegration time. It usually affects drug dissolution and release and it may affect bioavailability.

3.2.3.4.1 Procedure:

1. The slide scale of the hardness tester was made zero
2. One tablet was placed vertically between two jaws.
3. Force was applied with a screw thread and spring until the tablet fractured.
4. Reading in Kg was taken from the sliding scale.

3.2.3.5 Friability Test of Tablets:

Friction and shock are the forces that most often cause tablets to chip, cap or break. The friability test is closely related to tablet hardness and is designed to evaluate the ability of the tablet to withstand abrasion in packaging, handling and shipping. The value is expressed as a percentage.

3.2.3.5.1 Procedure:

1. 10 tablets were weighted. It was considered as an initial reading
2. The tablet were placed in the section 1 of the drum of the friability tester and rotated 100 times.
3. The tablets were re-weighted. It was considered as a final reading.

4. The percent loss was calculated.
5. According to the U.S.P the tablets should not lose more than 1% of their total weight

3.2.3.5.2 Calculation:

We used following formula to determined Friability of the tablets

% weight loss = (Initial weight – Final weight) ÷Initial weight × 100%

Chapter Four

RESULTS & DISCUSSION

4.1 RESULTS

4.1.1 Standard curve preparation

We have found different absorption for different concentration of Flupentixol dihydrochloride on the tablet solution following is a table of those concentration and absorbance.

Table 4.1

Concentration and Absorbance for Standard Curve of Flupentixol dihydrochloride

Concentration(mg/ml)	Absorbance at 229 nm
0.01	1.007
0.002	0.174
0.0004	0.038
0.00008	-0.009
0.000016	-0.013

By plotting the concentration against the absorbance of Flupentixol dihydrochloride we have found a straight line. From the Standard Curve of Flupentixol dihydrochloride we derived the equation Y=102.0X-0.015 and R^2=0.999. We use this equation to get the concentration from different samples absorbance of Flupentixol dihydrochloride.

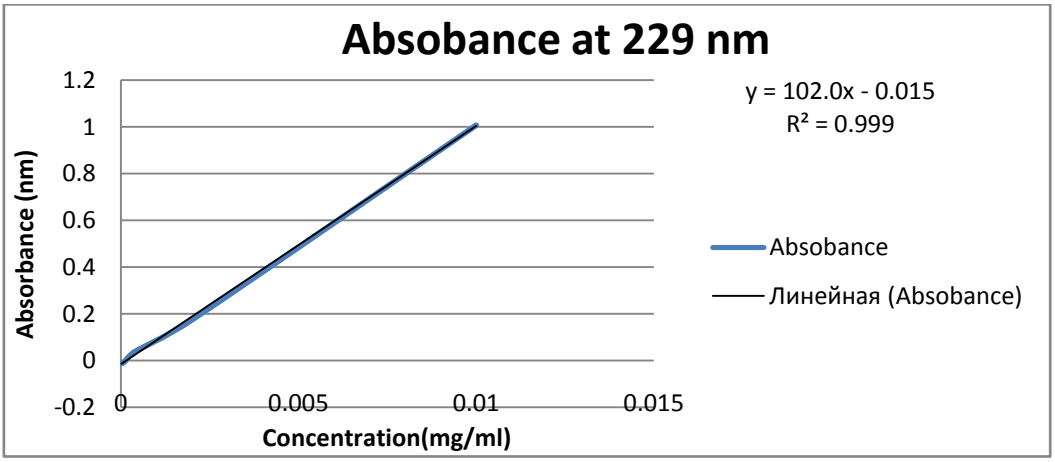

Figure 4.1: Standard curve of Flupentixol dihydrochloride

We have found different absorption for different concentration of Melitracen hydrochloride on the tablet solution following is a table of those concentration and absorbance.

Table 4.2

Concentration and Absorbance for Standard Curve of Melitracen hydrochloride

Concentration (mg/ml)	Absorbance at 258 nm
0.2	0.901
0.04	0.161
0.008	0.043
0.0016	0.002
0.00032	0.024

By plotting the concentration against the absorbance of Melitracen hydrochloride we have found a straight line. From the Standard Curve of Melitracen hydrochloride we derived the equation Y=4.471X+0.002 and R^2=0.998. We use this equation to get the concentration from different samples absorbance of Melitracen hydrochloride.

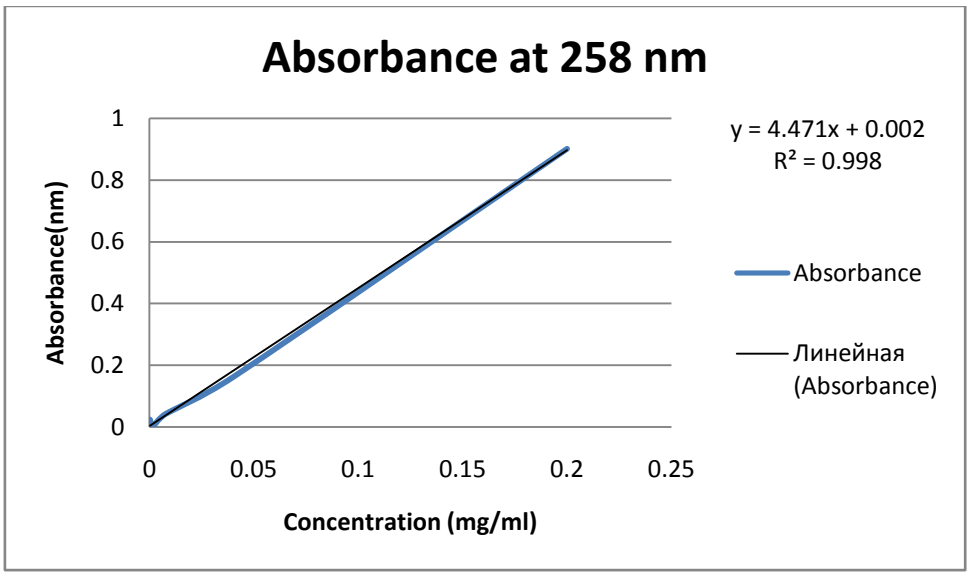

Figure 4.2: Standard curve of Melitracen hydrochloride

4.1.2 COLOR OBSERVATION TEST

We observed the color change by comparing the picture of light exposed sample tablets and the control tablets or the tablets which are not exposed in light. Followings are the pictures of those sample tablets and the control tablets which were not exposed in light.

4.1.2.1 Difference in color of Control Sample

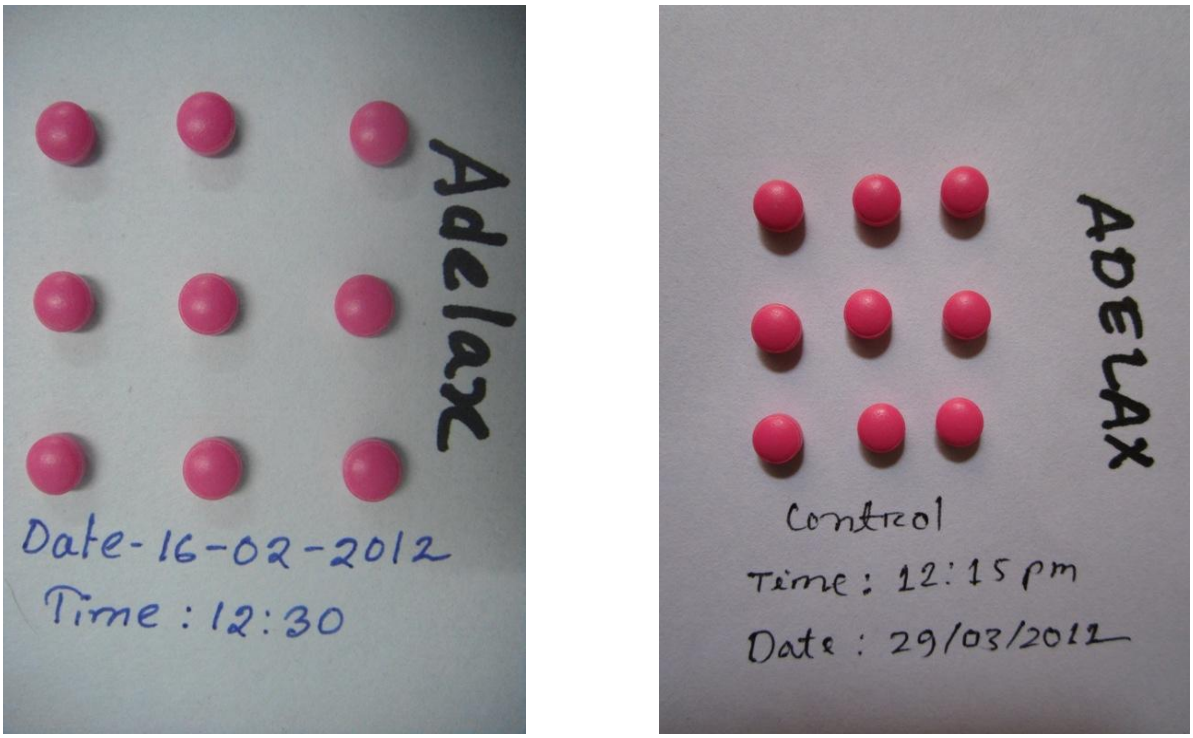

Figure 4.3: [Left to right Picture] of tablets as Control Sample at19th February 2012 (Control-1) and 29th March 2012 (Control-2)

4.2.1.2 Difference in color in each 3 Hour time interval for Sample that was kept under of 25 watts Electrical Bulb

Figure 4.4: [Left to right (3, 6 & 9 Hour Sample)] Picture of tablets in each 3 Hour time interval for Sample of 25 watts Electrical Bulb

4.2.1.3 Difference in color each 3 Hour time interval for Sample that was kept under of 40 watts Electrical Bulb

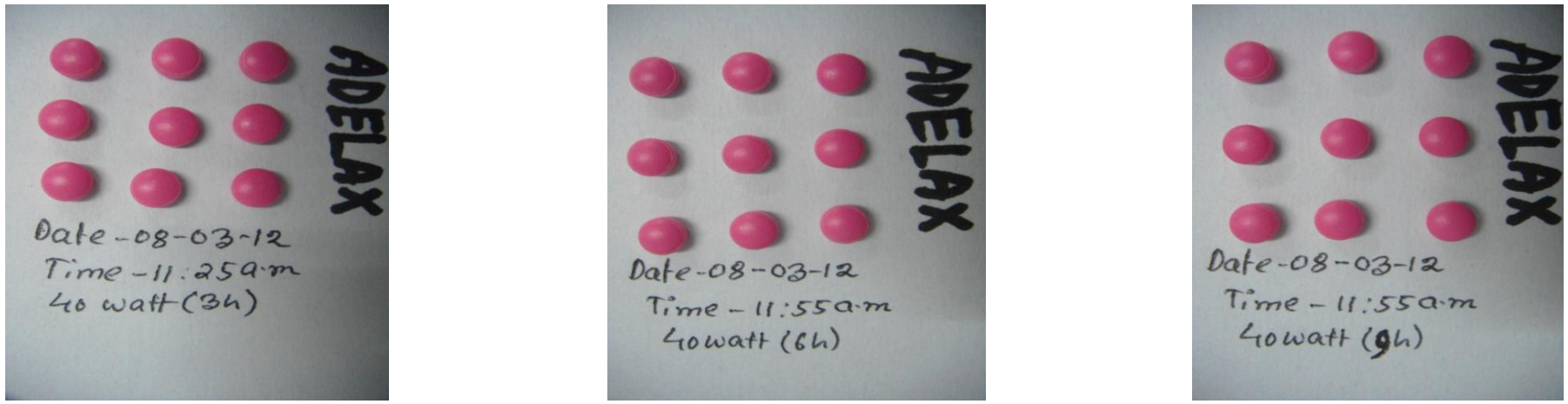

Figure 4.5: [Left to right (3, 6 & 9 Hour Sample)] Picture of tablets in each 3 Hour time interval for Sample of 40 watts Electrical Bulb

4.1.2.4 Difference in color in each 3 Hour time interval for Sample that was kept under Sunlight

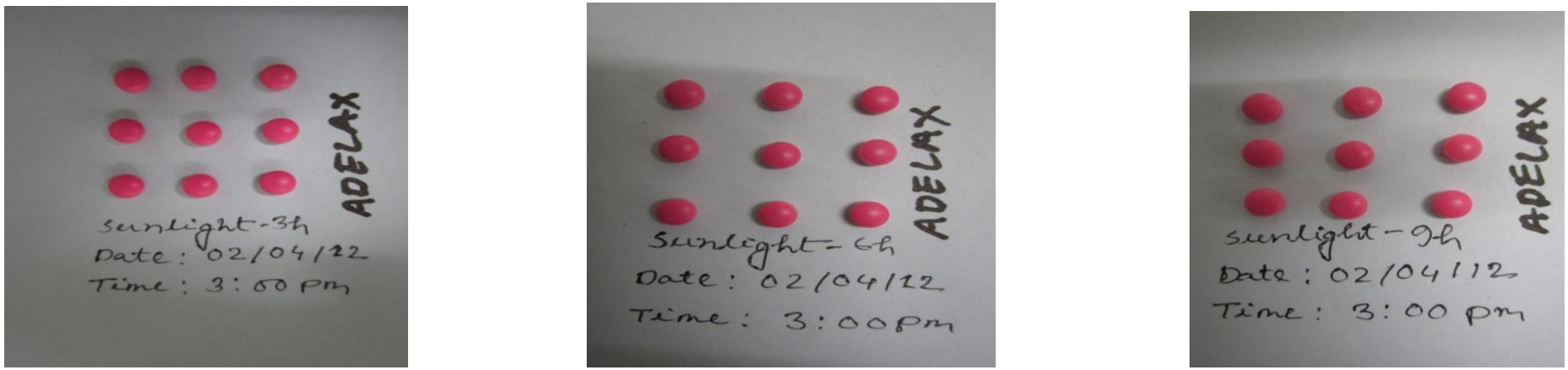

Figure 4.6: [Left to right (3, 6 & 9 Hour Sample)] Picture of tablets in each 3 Hour time interval for Sample of Sunlight

4.1.2.5 Difference in color for the Sample that was kept on Room temperature for stability testing

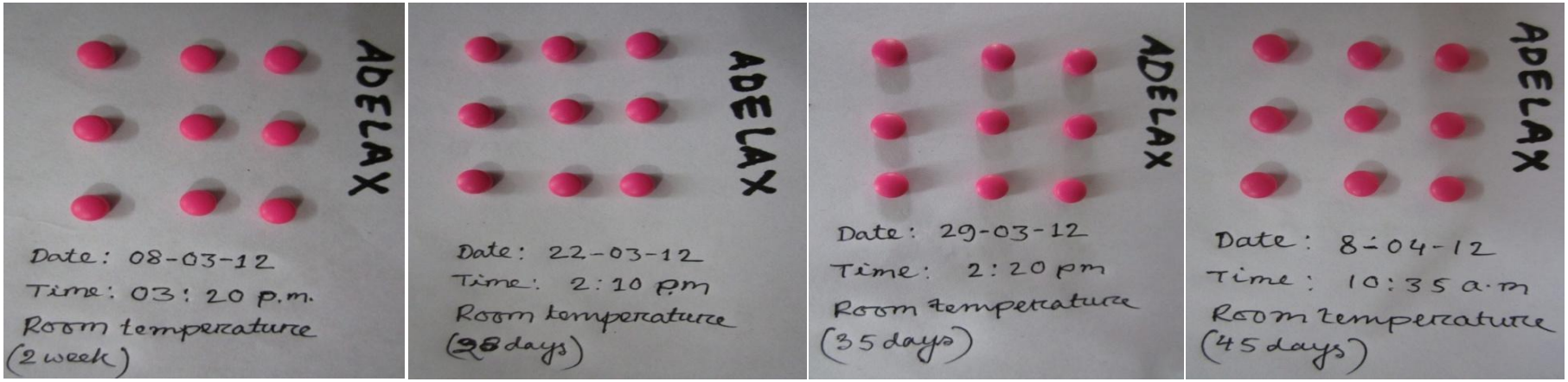

Figure 4.7: [Left to right (14, 28, 35 & 45 days Sample)] Picture of tablets in each definite time interval for Sample of Room temperature

From the above picture we can say that there were no changes of color due to various light exposures. The color of the tablets remains same.

4.1.3 WEIGHT VARIATION TEST

Weight variation test is important test for our experiment to understand whether the effect of light make any change in weight of tablet. For the weight variation test we weighted the tablet individually to determine the initial weight and then average weight from which we determine the % Weight Variation; by using (A~I/I) ×100 equation.

We have found a scatter position for the % Weight Variation; by plotting % Weight Variation in the Y-axis and the tablet no in the X-axis.

4.1.3.1 Control Sample

4.1.3.1.1 Control Sample of 19th February 2012 (Control Sample-1)

Table 4.3

Weight variation test of the tablets of Control Sample-1

Tablet no.	Initial Weight, I(gm)	Average weight A(gm)	Weight Variation (gm)	% Weight Variation; (A~I/I)×100
1	0.0893	0.8944/10 =0.08944	0.00157	0.0157
2	0.0889		0.00607	0.607
3	0.0915		-0.0225	2.251
4	0.0882		-0.0141	1.405
5	0.0908		-0.015	1.497
6	0.0901		-0.0073	0.7325
7	0.0903		-0.0095	0.952

8	0.0877	0.01984	1.984
9	0.0858	0.04242	4.242
10	0.0918	0.0257	2.57

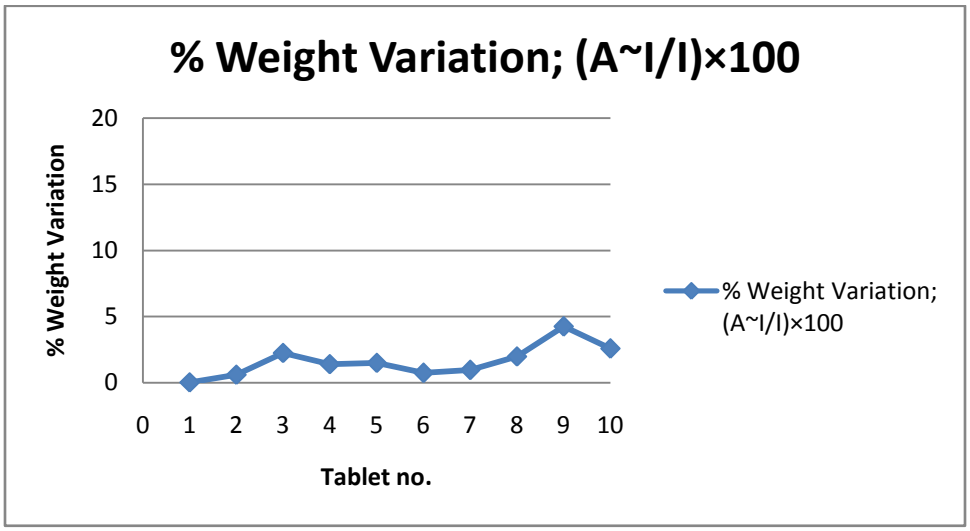

Figure 4.8: Plot showing scattered position of % Weight Variation of tablets of Control Sample 1

4.1.3.1.2 Control Sample of 29th March 2012 (Control Sample-2)

Table 4.4

Weight variation test of the tablets of Control Sample-2

Tablet no.	Initial Weight, I(gm)	Average weight A(gm)	Weight Variation (gm)	% Weight Variation; (A~I/I)×100
1	0.0893	0.8944/10 =0.08944	0.0011	0.11
2	0.0901		-0.0078	0.78
3	0.0893		0.0011	0.11
4	0.0892		0.0022	0.22
5	0.0896		-0.0022	0.22
6	0.0895		-0.0011	0.11
7	0.0887		0.0078	0.78

8	0.0881		0.015	1.5
9	0.0891		0.0033	0.33
10	0.0911		-0.0186	1.86

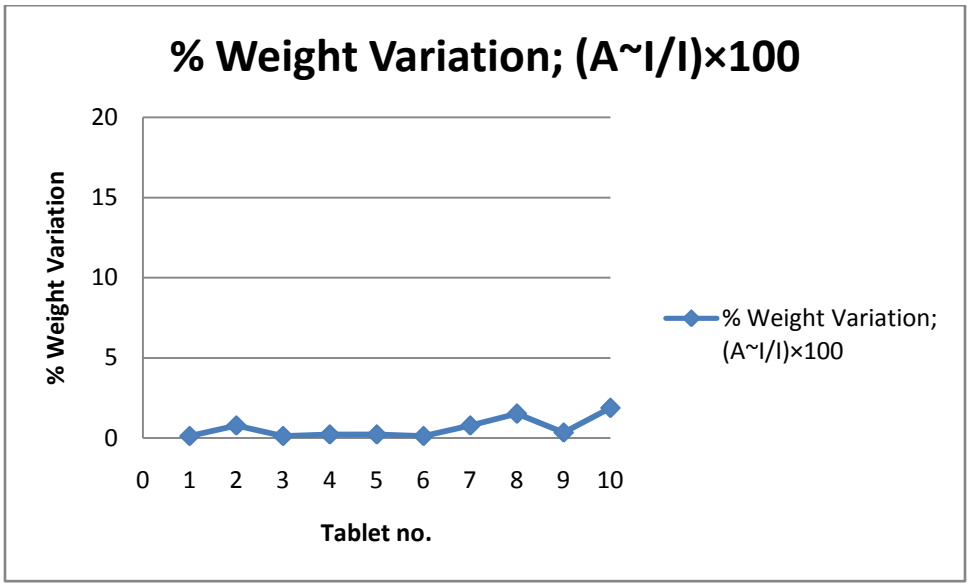

Figure 4.9: Plot showing scattered position of % Weight Variation of tablets of Control Sample 2

4.1.3.2 Sample that was kept under 25 watts Electrical Bulb

4.1.3.2.1 Three Hour Sample

Table 4.5

Weight variation test of the tablets of three hour sample of 25 watts electrical bulb

Tablet no.	Initial Weight, I(gm)	Average weight A(gm)	Weight Variation(gm)	% Weight Variation; (A~I/I)×100
1	0.0877		0.01665	1.665
2	0.0897	0.8916/10	0.006	0.06
3	0.0869	=0.08916	0.026	2.6
4	0.091		0.0202	2.02

5	0.0911	0.0021	0.021
6	0.0895	0.0038	0.38
7	0.0891	0.00067	0.067
8	0.0917	0.0277	2.77
9	0.0887	0.0052	0.52
10	0.0862	0.034	3.4

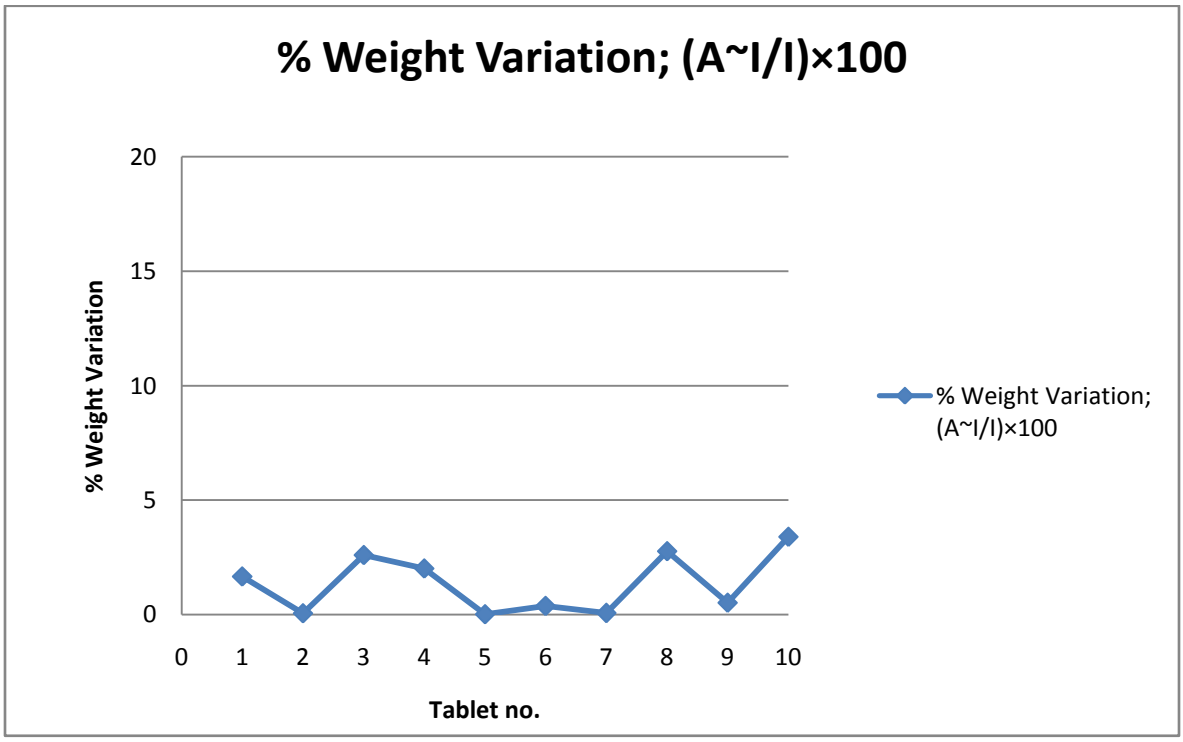

Figure 4.10: Plot showing scattered position of % Weight Variation of the tablets of three hour sample of 25 watts electrical bulb

4.1.3.2.2 Six Hour Sample

Table 4.6

Weight variation test of the tablets of six hour sample of 25 watts electrical bulb

Tablet no.	Initial Weight, I(gm)	Average weight A(gm)	Weight Variation(gm)	% Weight Variation; (A~I/I)×100
1	0.0863		0.0439	4.39
2	0.0912		-0.012	1.2
3	0.0906		-0.00051	0.051
4	0.0898		0.00269	0.269
5	0.0874	0.9009/10	0.0307	3.07
6	0.0912	=0.09009	-0.0011	0.11
7	0.0903		-0.0002	0.02
8	0.0918		-0.0186	1.86
9	0.0924		-0.0023	0.231
10	0.0899		0.0019	0.019

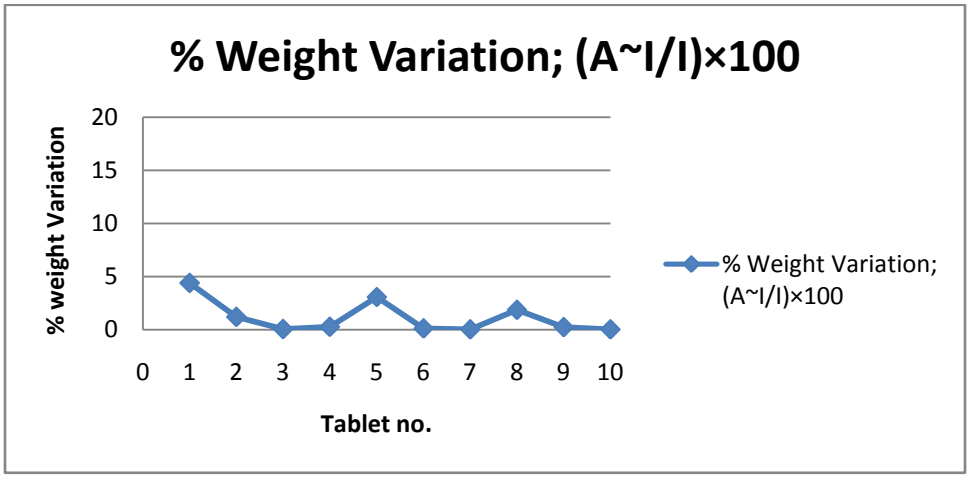

Figure 4.11: Plot showing scattered position of % Weight Variation of the tablets of six hour sample of 25 watts electrical bulb

4.1.3.2.3 Nine Hour Sample

Table 4.7

Weight variation test of the tablets of nine hour sample of 25 watts electrical bulb

Tablet no.	Initial Weight, I(gm)	Average weight A(gm)	Weight Variation (gm)	% Weight Variation; (A~I/I)×100
1	0.0887		0.0054	0.54
2	0.0883		0.0099	0.99
3	0.0894		-0.0002	0.02
4	0.0886		0.0005	0.058
5	0.0914	0.8918/10	-0.024	2.4
6	0.0899	=0.08918	-0.008	0.8
7	0.0893		-0.001	0.13
8	0.0881		0.0122	1.23
9	0.0891		0.0008	0.08
10	0.089		0.002	0.2

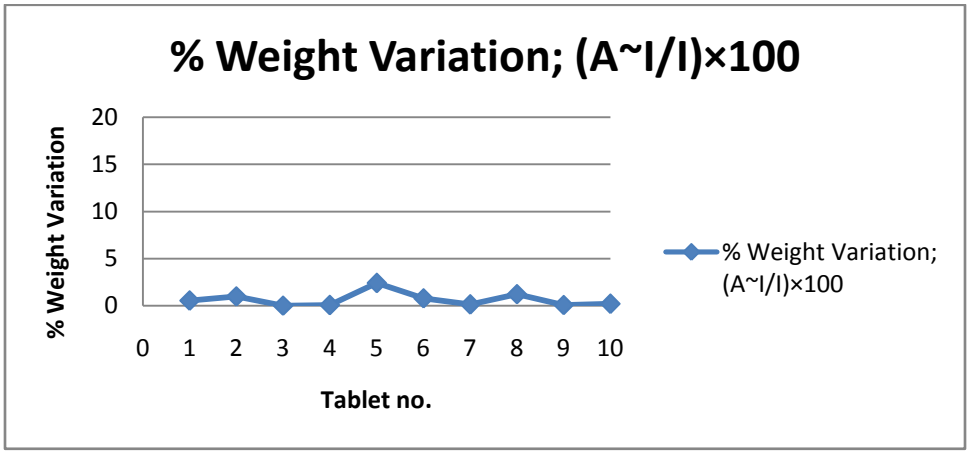

Figure 4.12: Plot showing scattered position of % Weight Variation of the tablets of nine hour sample of 25 watts electrical bulb

4.1.3.3 Sample that was kept under of 40 watts Electrical Bulb

4.1.3.3.1 Three Hour Sample

Table 4.8

Weight variation test of the tablets of three hour sample of 40 watts electrical bulb

Tablet no.	Initial Weight, I(gm)	Average weight A(gm)	Weight Variation (gm)	% Weight Variation; (A~I/I)×100
1	0.0921		-0.008	0.8
2	0.0934		-0.02	2.18
3	0.0901		0.013	1.3
4	0.0918		-0.0047	0.47
5	0.0921	0.9136/10	-0.008	0.8
6	0.0924	=0.09136	-0.011	1.1
7	0.0919		0.0058	0.58
8	0.0903		0.011	1.17
9	0.0902		0.013	1.3
10	0.0893		0.023	2.3

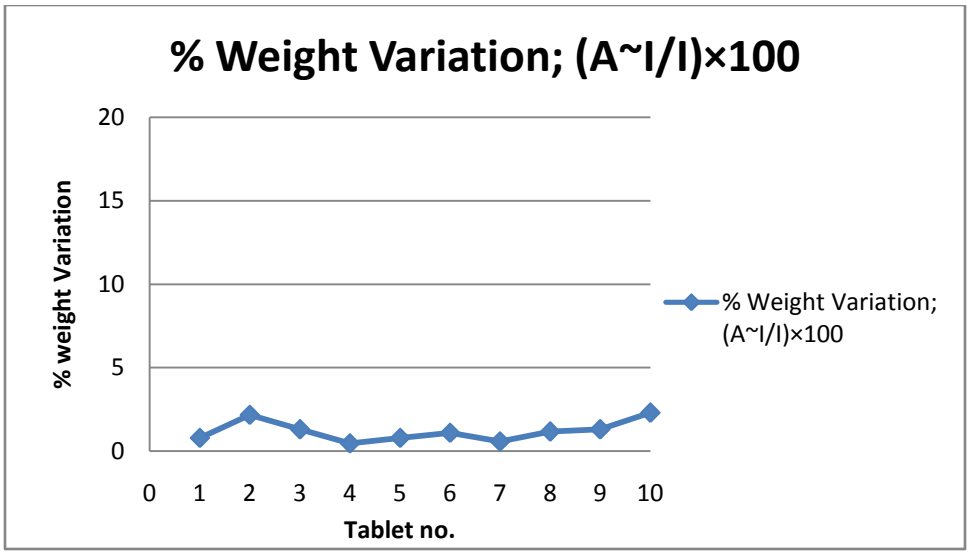

Figure 4.13: Plot showing scattered position of % Weight Variation of the tablets of three hour sample of 40 watts electrical bulb

4.1.3.3.2 Six Hour Sample

Table 4.9

Weight variation test of the tablets of six hour sample of 40 watts electrical bulb

Tablet no.	Initial Weight, I(gm)	Average weight A(gm)	Weight Variation (gm)	% Weight Variation; (A~I/I)×100
1	0.088	0.9024/10 =0.09024	0.025	2.5
2	0.0909		0.0072	0.72
3	0.0896		0.0071	0.71
4	0.0922		-0.0212	2.12
5	0.0929		0.028	2.86
6	0.0897		0.006	0.6
7	0.0897		0.006	0.6
8	0.0909		-0.00066	0.066
9	0.0891		0.0011	0.114

10	0.0894		0.00084	0.084

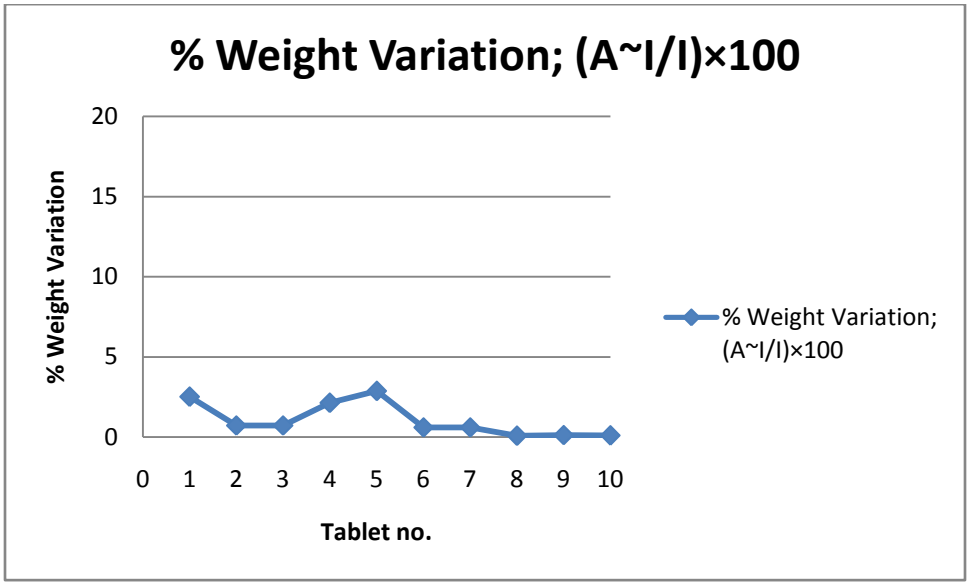

Figure 4.14: Plot showing scattered position of % Weight Variation of the tablets of six hour sample of 40 watts electrical bulb

4.1.3.3.3 Nine Hour Sample

Table 4.10

Weight variation test of the tablets of nine hour sample of 40 watts electrical bulb

Tablet no.	Initial Weight, I(gm)	Average weight A(gm)	Weight Variation (gm)	% Weight Variation; (A~I/I)×100
1	0.0906		0.0137	1.37
2	0.0929		-0.0113	1.1
3	0.0932	0.9185/10	-0.0144	1.4
4	0.0925	=0.09185	-0.007	0.7
5	0.0916		0.0027	0.27
6	0.0887		0.0355	3.55

7	0.0907	0.012	1.2
8	0.0921	-0.0027	0.02
9	0.0934	-0.016	1.6
10	0.0928	-0.01	1

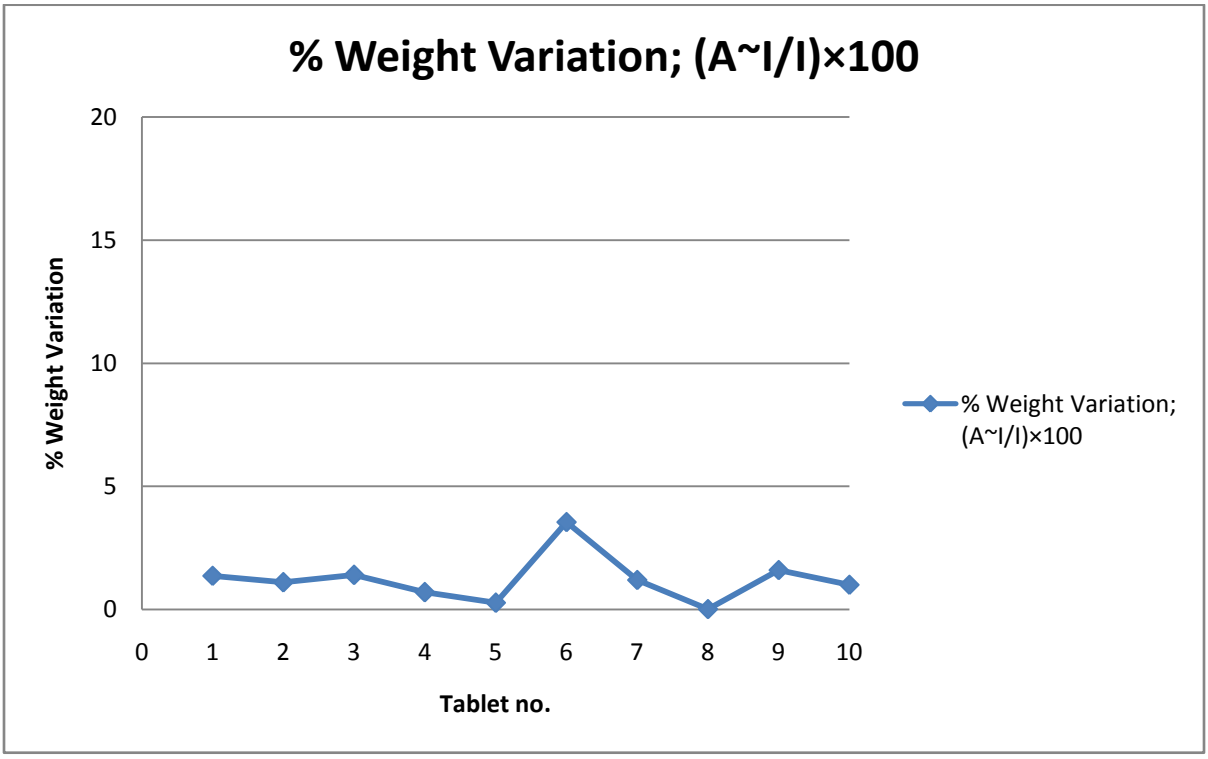

Figure 4.15: Plot showing scattered position of % Weight Variation of the tablets of nine hour sample of 40 watts electrical bulb

4.1.3.4 Sample that was kept under Sunlight

4.1.3.4.1 Three Hour Sample

Table 4.11

Weight variation test of the tablets of three hour sample of sunlight

Tablet no.	Initial Weight, I(gm)	Average weight A(gm)	Weight Variation	% Weight Variation; (A~I/I)×100
1	0.0908	0.9084/10 =0.09084	0.00044	0.044
2	0.0896		0.0138	1.38
3	0.0909		-0.00066	0.066
4	0.0904		0.0049	0.49
5	0.0936		-0.029	2.9
6	0.0901		0.0082	0.82
7	0.0908		0.00044	0.044
8	0.0903		0.0059	0.59
9	0.0898		0.12	1.2
10	0.0921		-0.014	1.4

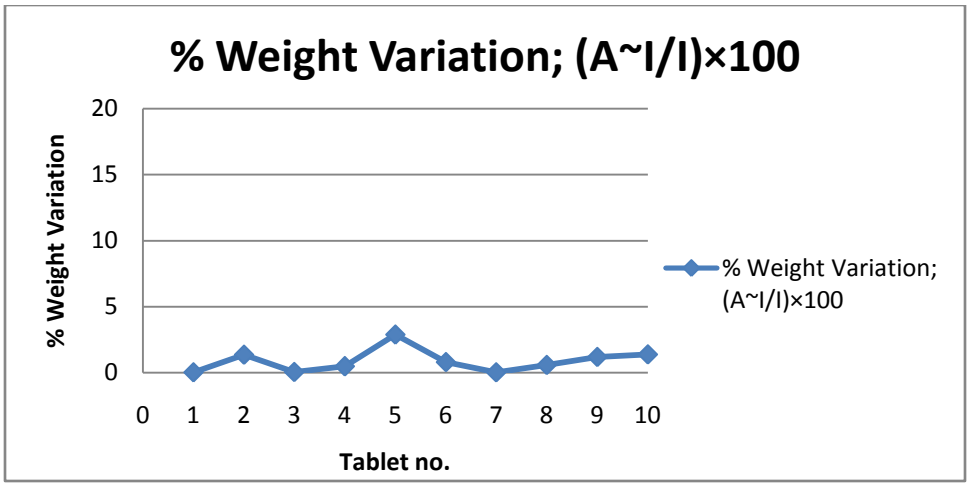

Figure 4.16: Plot showing scattered position of % Weight Variation of the tablets of three hour sample of sunlight

4.1.3.4.2 Six Hour Sample

Table 4.12

Weight Variation test of the tablets of six hour sample of sunlight

Tablet no.	Initial Weight, I(gm)	Average weight A(gm)	Weight Variation (gm)	% Weight Variation; (A~I/I)×100
1	0.0919	0.9087/10 =0.09087	-0.0011	1.1
2	0.0894		0.016	1.6
3	0.0911		-0.0025	0.25
4	0.0918		-0.01	1
5	0.0899		0.0107	1.07
6	0.0902		0.0074	0.74
7	0.0919		-0.0112	1.12
8	0.0902		0.0074	0.74
9	0.0923		0.015	1.5
10	0.09		0.0097	0.97

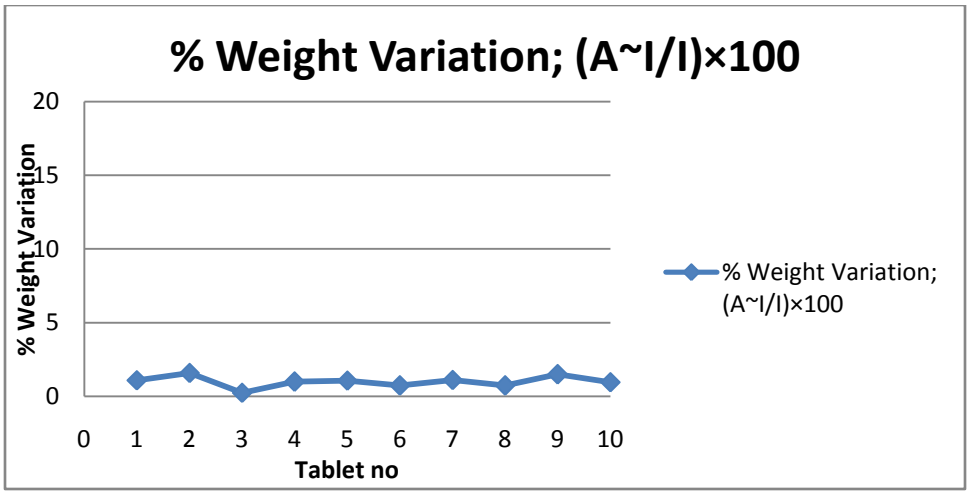

Figure 4.17: Plot showing scattered position of % Weight Variation of the tablets of six hour sample of sunlight

4.1.3.4.3 Nine Hour Sample

Table 4.13

Weight Variation test of the tablets of nine hour sample of sunlight

Tablet no.	Initial Weight, I(gm)	Average weight A(gm)	Weight Variation (gm)	% Weight Variation; (A~I/I)×100
1	0.0923	0.8982/10 =0.08982	-0.027	2.7
2	0.0895		0.0036	0.36
3	0.0897		0.0013	0.13
4	0.0892		0.0069	0.69
5	0.0888		0.0011	0.11
6	0.0897		0.0013	0.13
7	0.0914		-0.017	1.7
8	0.0876		0.025	2.5
9	0.0905		-0.0075	0.75
10	0.0895		0.0036	0.36

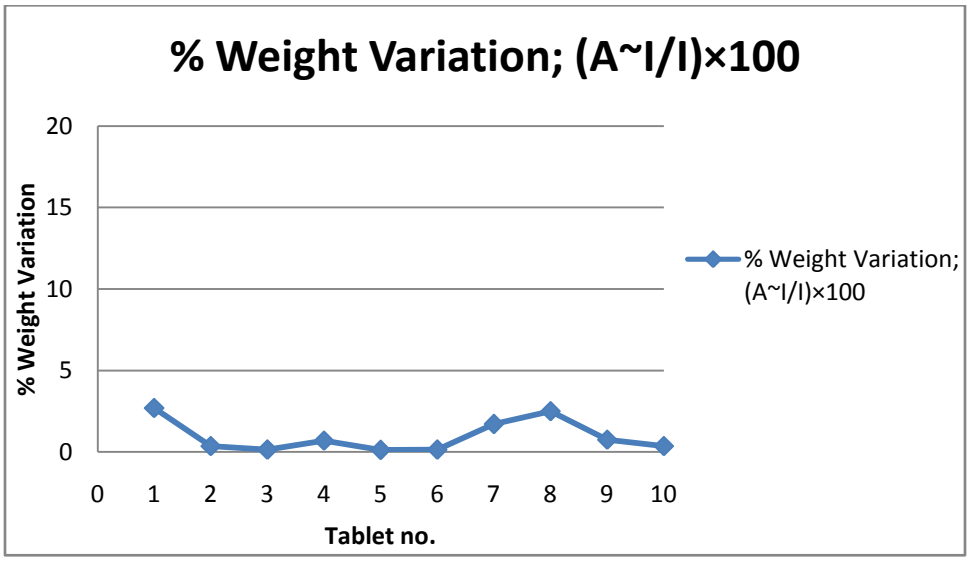

Figure 4.18: Plot showing scattered position of % Weight Variation of the tablets of nine hour sample of sunlight

4.1.3.4 Sample prepared on Room temperature for stability testing: Preservation of sample started at 23rd February 2012

4.1.3.4.1 Room temperature stability testing (14 days Sample)

Table 4.14

Weight variation test of the tablets of 14 days sample

Tablet no.	Initial Weight, I(gm)	Average weight A(gm)	Weight Variation	% Weight Variation; (A~I/I)×100
1	0.0923	0.9116/10 =0.09116	-0.012	1.2
2	0.0924		-0.013	1.3
3	0.0913		0.001	0.1
4	0.093		-0.019	1.9

5	0.0906	0.0061	0.61
6	0.0889	0.025	2.5
7	0.0911	0.00006	0.006
8	0.0912	-0.00004	0.004
9	0.0901	0.00106	0.106
10	0.0907	0.00046	0.046

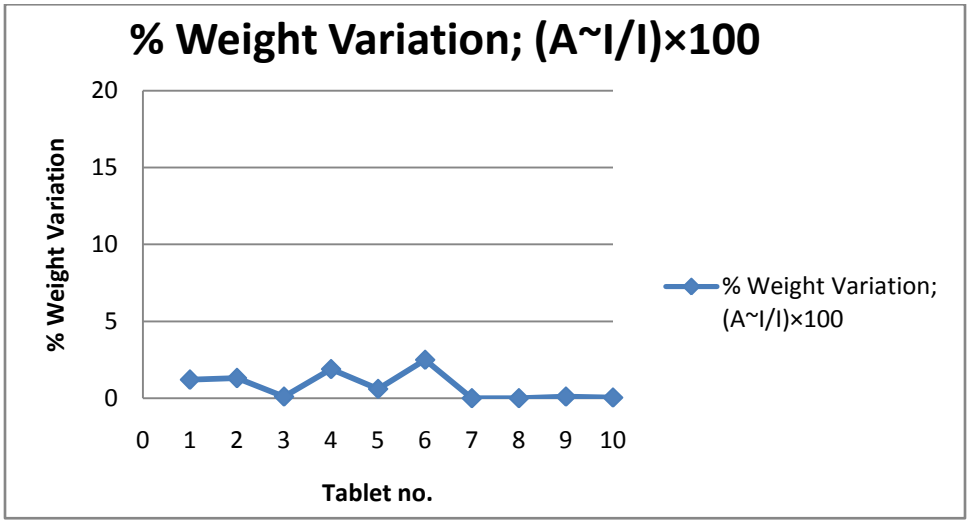

Figure 4.19: Plot showing scattered position of % Weight Variation of the tablets of 14 days sample

4.1.3.4.2 Room temperature stability testing (28 days Sample)

Table 4.15

Weight variation test of the tablets of 28 days sample

Tablet no.	**Initial Weight, I(gm)**	**Average weight A(gm)**	**Weight Variation (gm)**	**% Weight Variation; (A~I/I)×100**
1	0.0915	0.9137/10	-0.0014	0.14

2	0.0918	=0.09137	-0.0046	0.46
3	0.0918		-0.0046	0.46
4	0.091		0.004	0.4
5	0.0903		0.0118	1.18
6	0.0934		-0.021	2.1
7	0.0897		0.0186	1.86
8	0.0916		-0.0025	0.25
9	0.0903		0.0118	1.18
10	0.0923		-0.01	1

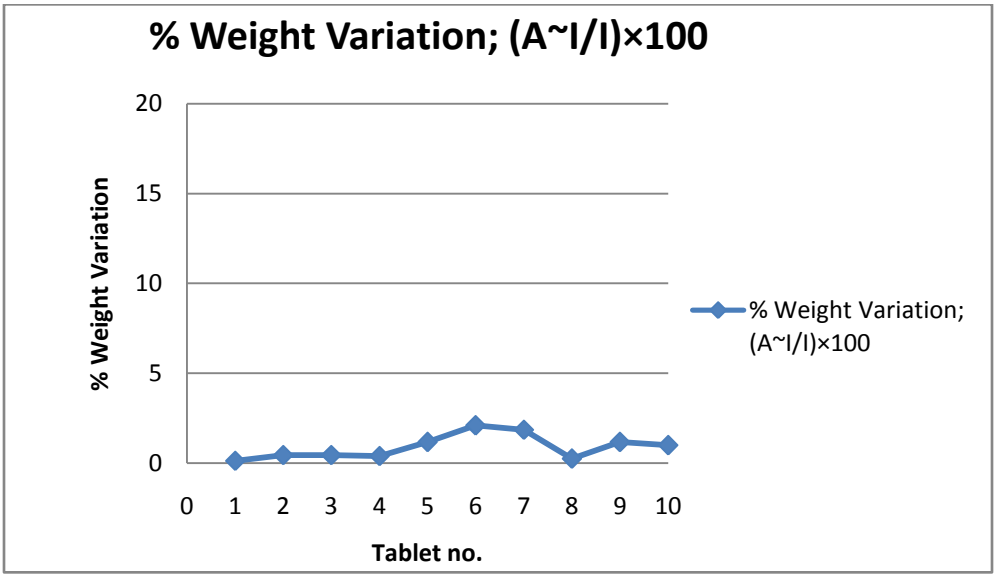

Figure 4.20: Plot showing scattered position of % Weight Variation of the tablets of 28 days sample

4.1.3.4.3 Room temperature stability testing (35 days Sample)

Table 4.16

Weight variation test of the tablets of 35 days sample

Tablet no.	Initial Weight, I(gm)	Average weight A(gm)	Weight Variation (gm)	% Weight Variation; (A~I/I)×100
1	0.0908		0.0079	0.79
2	0.0913		0.0024	0.24
3	0.0916		-0.00087	0.0087
4	0.0916		-0.00087	0.0087
5	0.0905	0.9152/10	0.011	1.1
6	0.0927	=0.09152	-0.0127	1.27
7	0.0934		-0.02	2
8	0.0895		0.022	2
9	0.0918		-0.003	0.3
10	0.092		-0.00048	0.048

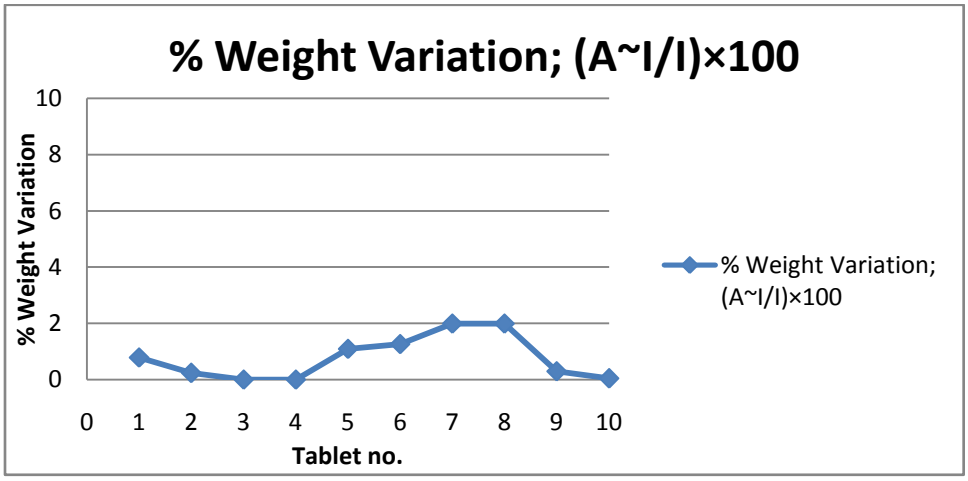

Figure 4.21: Plot showing scattered position of % Weight Variation of the tablets of 35 days sample

4.1.3.4.4 Room temperature stability testing (45 days Sample)

Table 4.17

Weight variation test of the tablets of 45 days sample

Tablet no.	Initial Weight, I(gm)	Average weight A(gm)	Weight Variation (gm)	% Weight Variation; (A~I/I)×100
1	0.0918		-0.0025	0.25
2	0.0921		-0.0057	0.57
3	0.0897		0.0208	2.08
4	0.092		-0.0047	0.47
5	0.0906	0.9157/10	0.0107	1.07
6	0.0915	=0.09157	0.00076	0.76
7	0.0914		0.00186	0.186
8	0.0928		-0.0133	1.33
9	0.0929		-0.014	1.4
10	0.0909		0.007	0.7

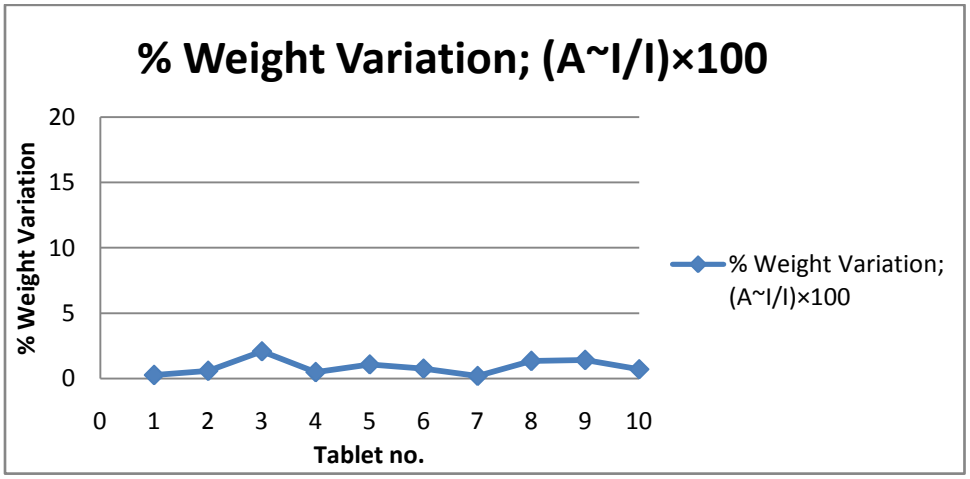

Figure 4.22: Plot showing scattered position of % Weight Variation of the tablets of 45 days sample

In our experiment we have seen that the percentage of Weight Variation of the sample tablets was within the accepted range (Weight of tablet 130 mg or less then %error = ±10%) and the tablet pass the test because no more that 2 tablets are outside the percentage limit and no tablet differs by more than 2 times the percentage limit.

4.1.4 THICKNESS TEST:

In our experiment we performed thickness test to observe any change in the diameter of the tablet due to the effect of light. We performed this test at different time interval. For the thickness test we determined the thickness of individual tablets by using Vernier Caliper. We used following formula to determined thickness of the tablets.

Thickness of the table = reading of cm scale + reading of Vernier scale + Vernier error

Table 4.18: Thickness of the tablets

Tablet no.	Main scale reading(cm), M	Vernier scale reading(cm), V	Thickness of the tablets (cm), i.e.(M+V) cm
1	0.35	0.03	0.38
2	0.35	0.03	0.38
3	0.35	0.03	0.38
4	0.35	0.03	0.38
5	0.35	0.03	0.38
6	0.35	0.03	0.38
7	0.35	0.03	0.38
8	0.35	0.03	0.38
9	0.35	0.03	0.38
10	0.35	0.03	0.38

In here, we have found a scatter position which is a straight line for the thickness of the tablets; by plotting thickness of the tablets in the Y-axis and the tablet no in the X-axis.

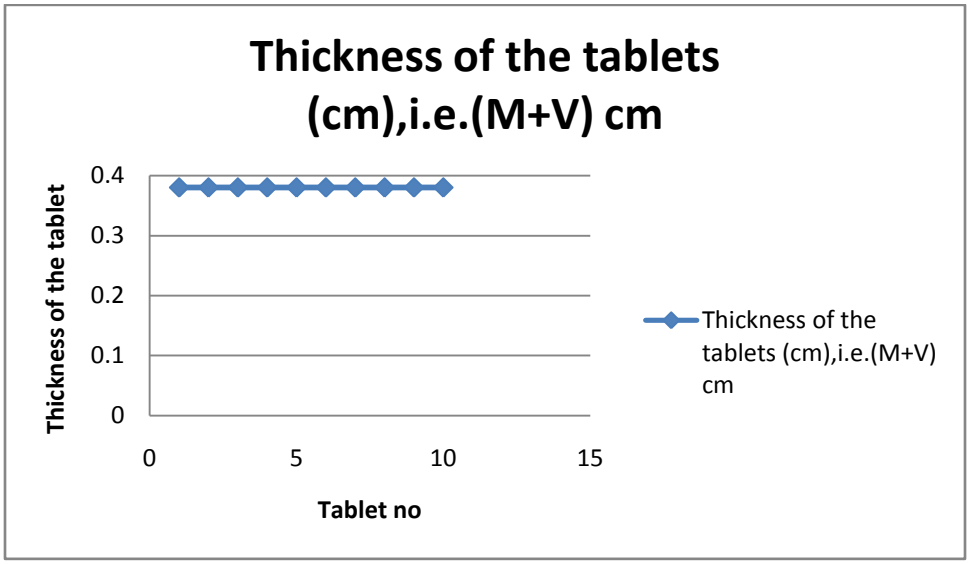

Figure 4.23: Plot showing straight line for tablets thickness

For all the samples i.e. The Control Sample, Sample that was kept under 25 watts Electrical Bulb, Sample that was kept under of 40 watts Electrical Bulb, Sample that was kept under Sunlight and the Room temperature Sample for stability testing i.e. 14 days Sample, 28 days Samples, 35 days Samples, 45 days Samples their thickness remains the same. There was no change in tablets thickness.

4.1.5 FRIABILITY TEST

It is the tendency of tablets to powder, chip, or fragment and this can affect the elegance appearance, consumer acceptance of the tablet, and also add to tablet's weight variation or content uniformity problems. Friability is a property that is related to the hardness of the tablet. For the friability test initial weight of ten tablets were taken and then final weight of those ten tablets were taken after rotation. The percentage of weight loss was calculated by using the following formula: % weight loss = (Initial weight – Final weight)÷Initial weight × 100% and we have found column diagram where we plot the Initial weight (gm) and Weight after rotation (gm) which shows the difference between them for control sample.

4.1.5.1 Control Sample

4.1.5.1.1Control Sample of 19th February 2012 (Control Sample-1)

Table 4.19

Friability test of the tablets of Control Sample-1

Initial weight (gm)	Weight after rotation (gm)	Friability
0.8946	0.8926	0.22%

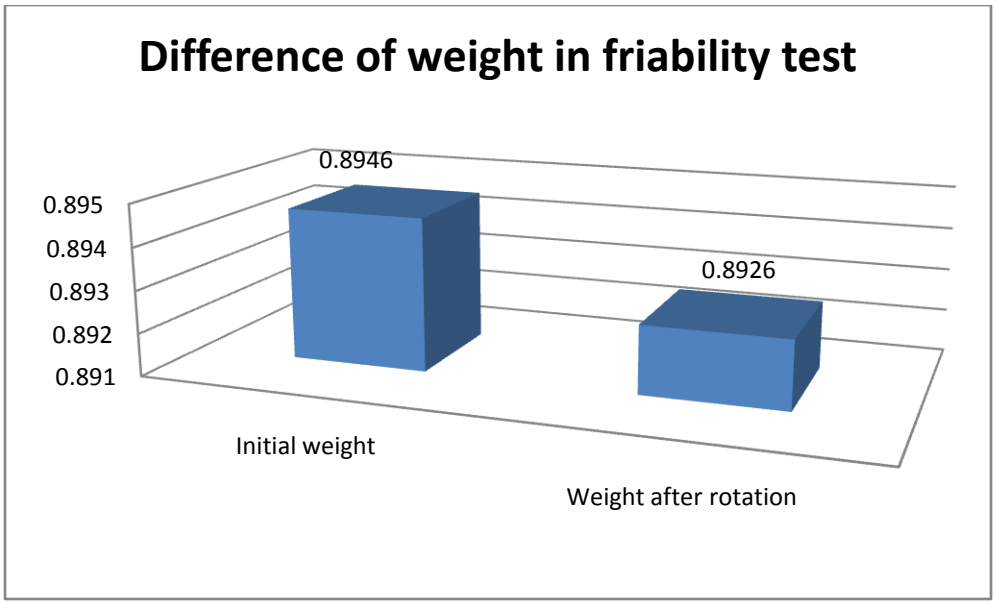

Figure 4.24: Column showing the difference of Initial weight (gm) with Weight after rotation (gm) of the tablets of Control Sample 1

4.1.5.1.2 Control Sample of 29th March 2012 (Control Sample-2)

Table 4.20

Friability test of the tablets of Control Sample-2

Initial weight (gm)	Weight after rotation(gm)	Friability
0.8875	0.8872	0.03%

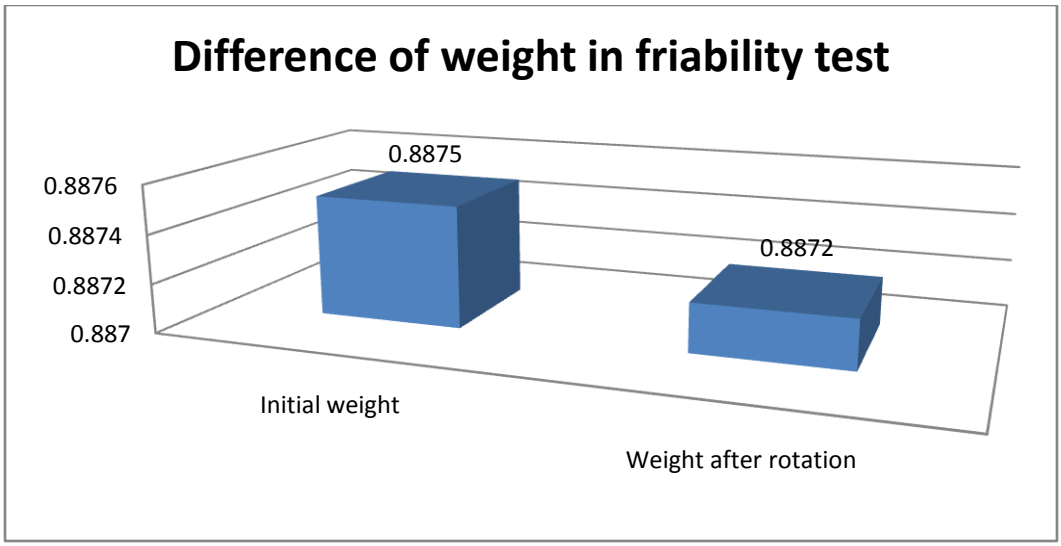

Figure 4.25: Column showing the difference of Initial weight (gm) with Weight after rotation (gm) of the tablets of Control Sample 2

4.1.5.2 Sample that was kept under 25 watts Electrical Bulb

4.1.5.2.1 Three Hour Sample

Table 4.21

Friability test of the tablets of three hour sample of 25 watts electrical bulb

Initial weight (gm)	Weight after rotation (gm)	Friability
0.8925	0.8923	0.22%

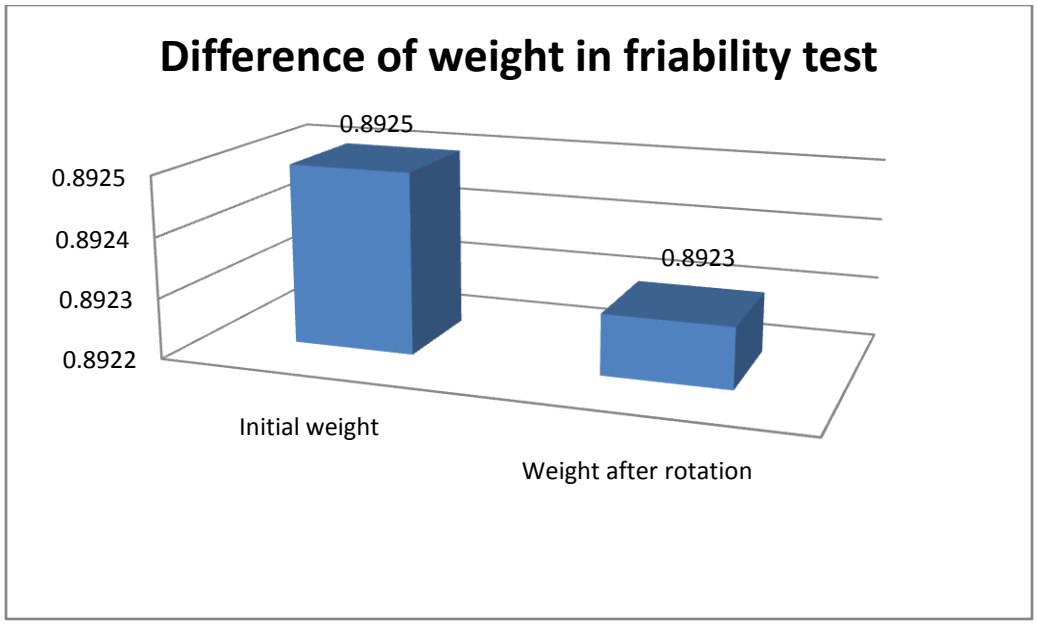

Figure 4.26: Column showing the difference of Initial weight (gm) with Weight after rotation (gm) of the tablets of three hour sample of 25 watts electrical bulb

4.1.5.1.2.2 Six Hour Sample

Table 4.22

Friability test of the tablets of six hour sample of 25 watts electrical bulb

Initial weight (gm)	Weight after rotation (gm)	Friability
0.9026	0.8784	2.68%

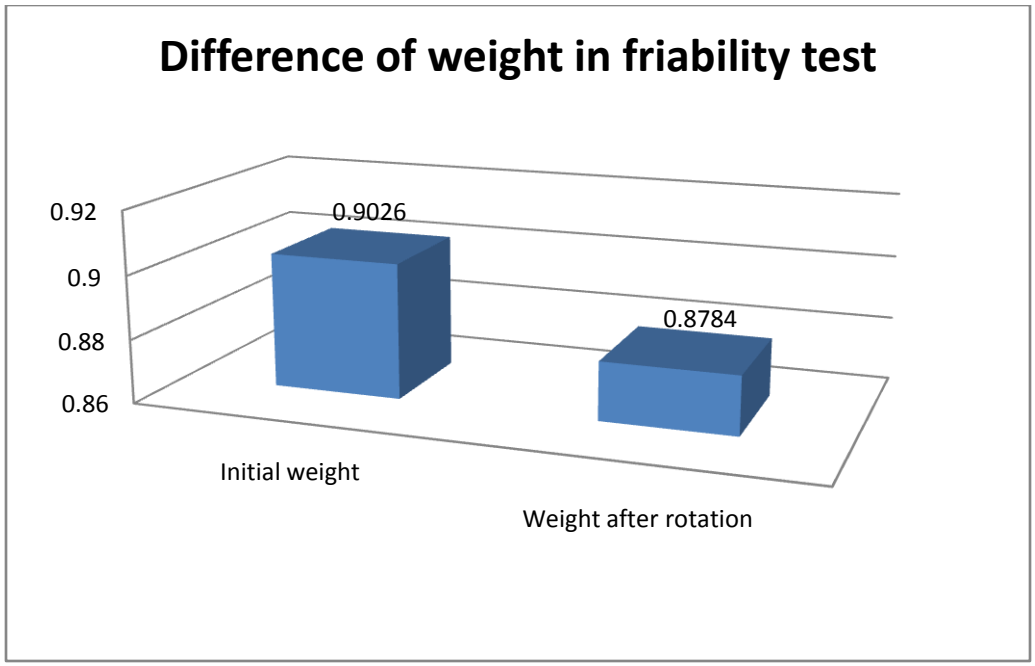

Figure 4.27: Column showing the difference of Initial weight (gm) with Weight after rotation (gm) of the tablets of six hour sample of 25 watts electrical bulb

4.1.5.2.3 Nine Hour Sample

Table 4.23

Friability test of the tablets of nine hour sample of 25 watts electrical bulb

Initial weight (gm)	Weight after rotation (gm)	Friability
0.8927	0.8921	0.07%

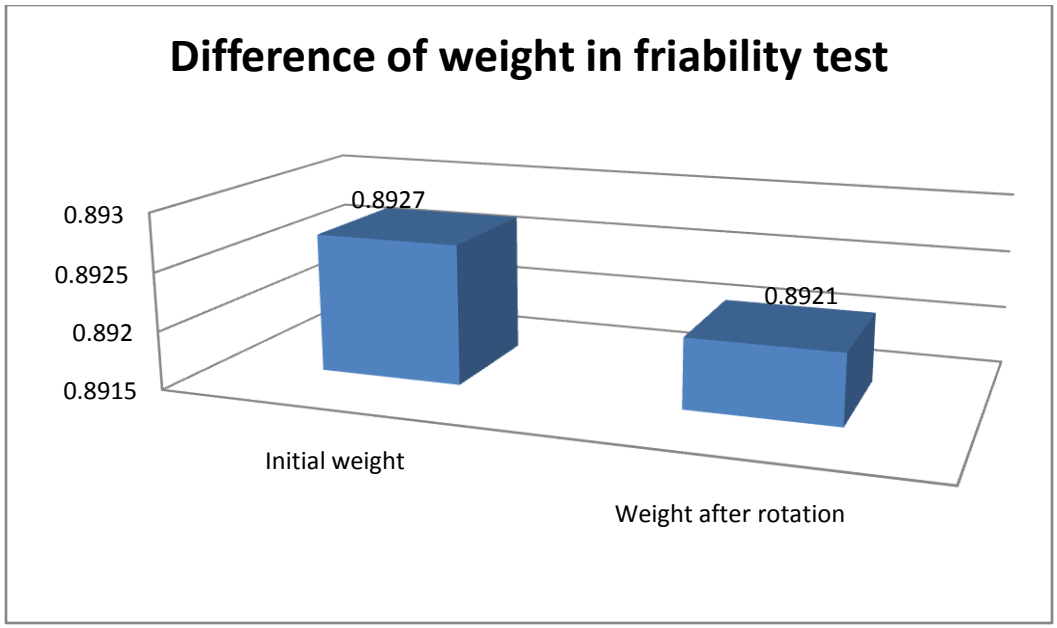

Figure 4.28: Column showing the difference of Initial weight (gm) with Weight after rotation (gm) of the tablets of nine hour sample of 25 watts electrical bulb

4.1.5.3 Sample that was kept under of 40 watts Electrical Bulb

4.1.5.3.1 Three Hour Sample

Table 4.24

Friability test of the tablets of three hour sample of 40 watts electrical bulb

Initial weight (gm)	Weight after rotation (gm)	Friability
0.9106	0.9104	0.02%

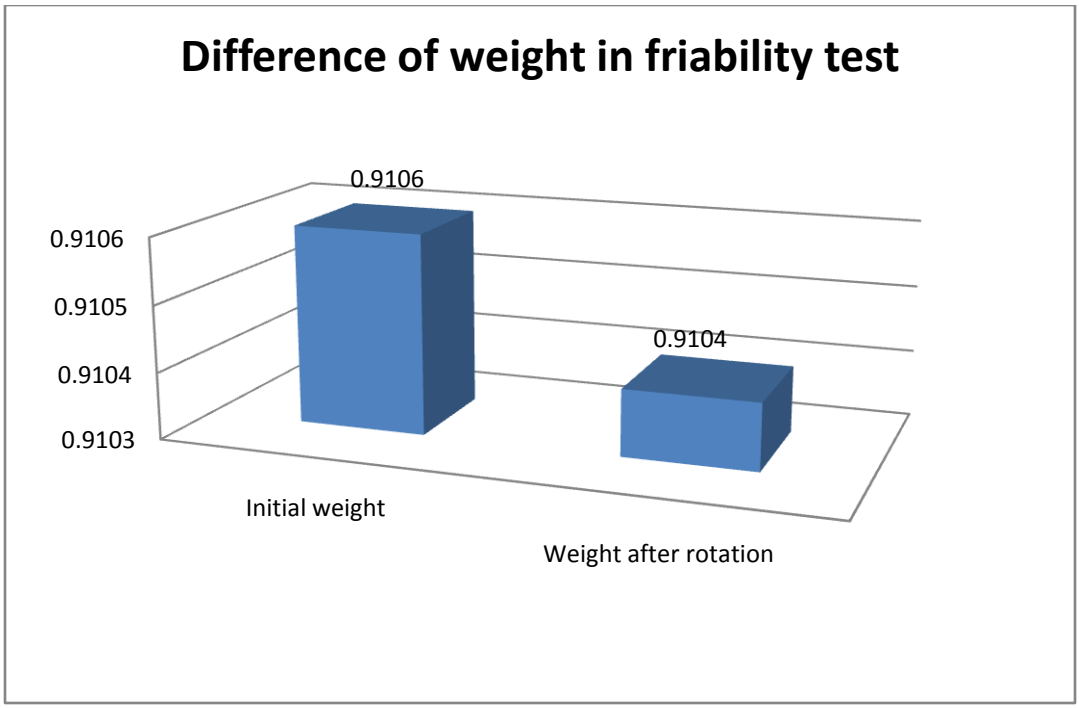

Figure 4.29: Column showing the difference of Initial weight (gm) with Weight after rotation (gm) of the tablets of three hour sample of 40 watts electrical bulb

4.1.4.3.2 Six Hour Sample

Table 4.25

Friability test of the tablets of six hour sample of 40 watts electrical bulb

Initial weight (gm)	Weight after rotation (gm)	Friability
0.9031	0.9026	0.06%

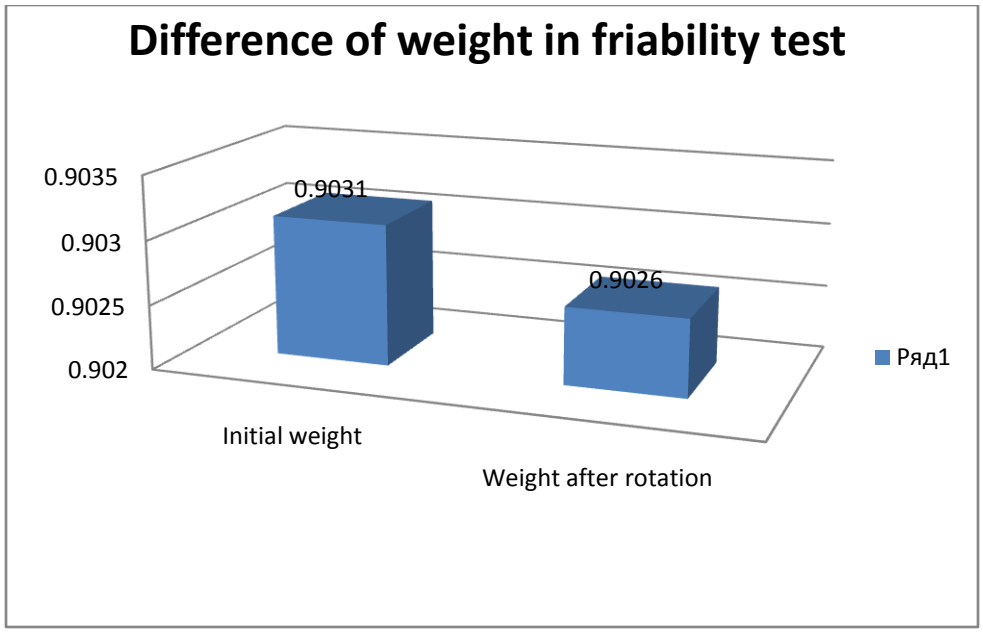

Figure 4.30: Column showing the difference of Initial weight (gm) with Weight after rotation (gm) of the tablets of six hour sample of 40 watts electrical bulb

4.1.4.3.3 Nine Hour Sample

Table 4.26

Friability test of the tablets of nine hour sample of 40 watts electrical bulb

Initial weight (gm)	Weight after rotation (gm)	Friability
0.9198	0.9161	0.40%

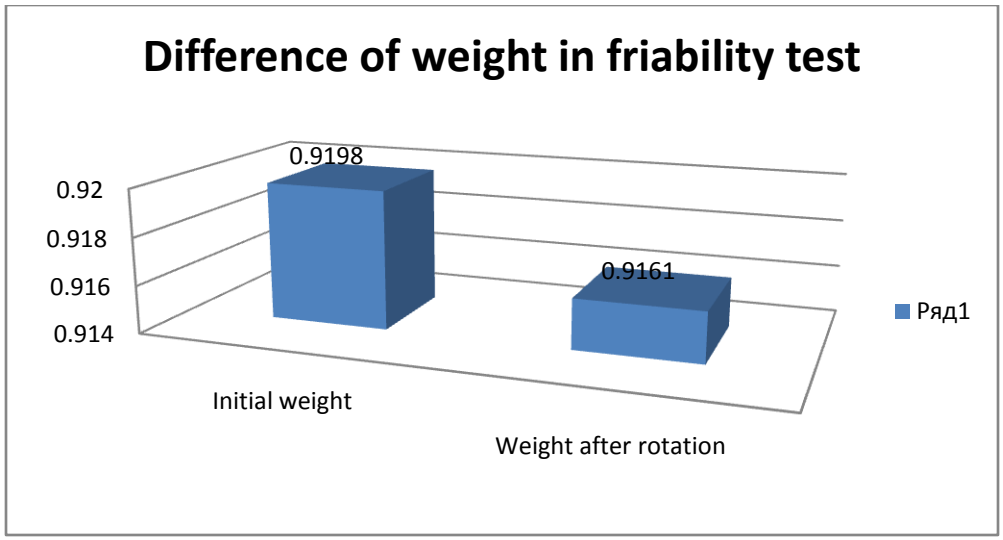

Figure 4.31: Column showing the difference of Initial weight (gm) with Weight after rotation (gm) of the tablets of nine hour sample of 40 watts electrical bulb

4.1.5.4 Sample that was kept under Sunlight

4.1.5.4.1 Three Hour Sample

Table 4.27

Friability test of the tablets of three hour sample of sunlight

Initial weight (gm)	Weight after rotation (gm)	Friability
0.9055	0.9054	0.01%

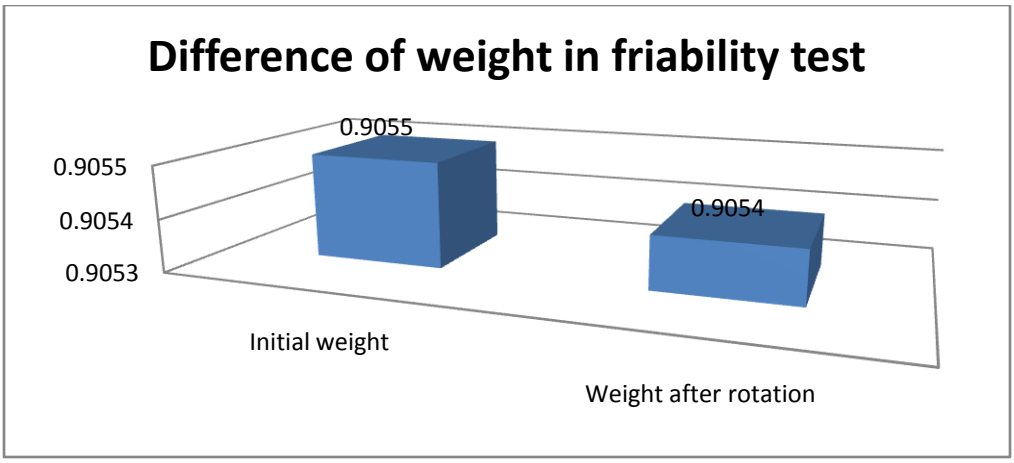

Figure 4.32: Column showing the difference of Initial weight (gm) with Weight after rotation (gm) of the tablets of three hour sample of sunlight

4.1.5.4.2 Six Hour Sample

Table 4.28

Friability test of the tablets of six hour sample of sunlight

Initial weight (gm)	Weight after rotation (gm)	Friability
0.9061	0.9056	0.06%

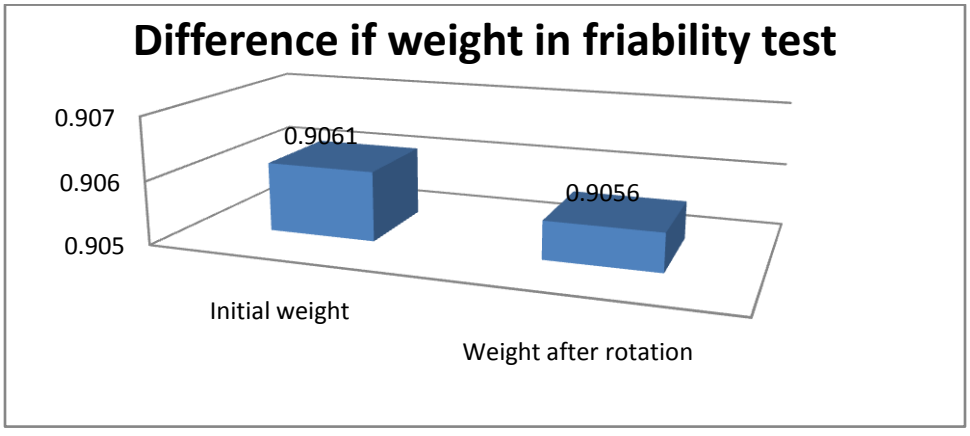

Figure 4.33: Column showing the difference of Initial weight (gm) with Weight after rotation (gm) of the tablets of six hour sample of sunlight

4.1.5.4.3 Nine Hour Sample

Table 4.29

Friability test of the tablets of nine hour sample of sunlight

Initial weight	Weight after rotation	Friability
0.8962	0.896	0.02%

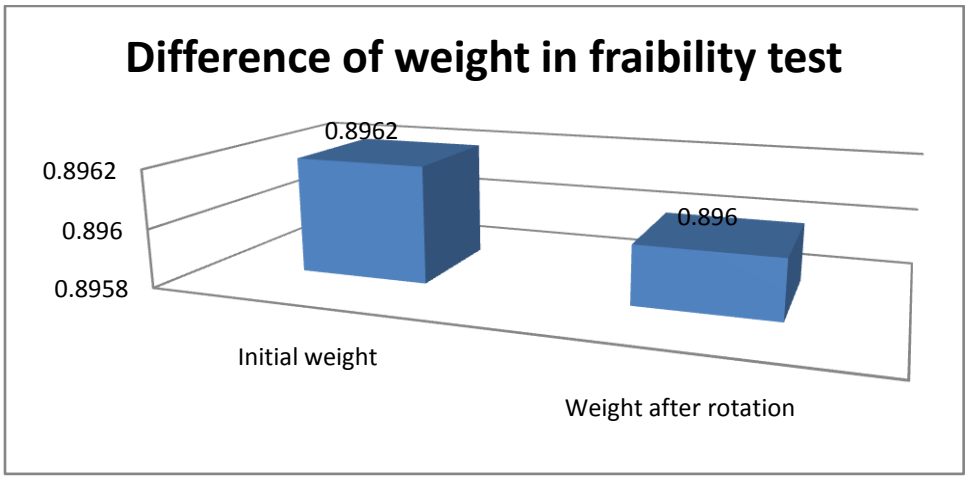

Figure 4.34: Column showing the difference of Initial weight (gm) with Weight after rotation (gm) of the tablets of nine hour sample of sunlight

4.1.5.5 Sample prepared on Room temperature for stability testing: Preservation of sample started at 23rd February 2012

4.1.5.5.1 Room temperature stability testing (14 days Sample)

Table 4.30

Friability test of the tablets of 14 days sample

Initial weight (gm)	Weight after rotation (gm)	Friability
0.9117	0.9101	0.40%

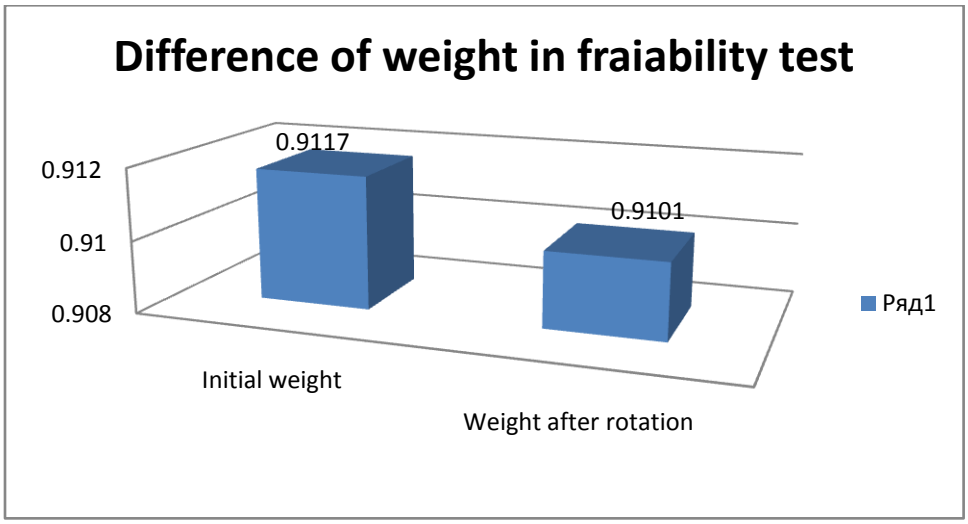

Figure 4.35: Column showing the difference of Initial weight (gm) with Weight after rotation (gm) of the tablets of 14 days sample

4.1.5.5.2 Room temperature stability testing (28 days Sample)

Table 4.31

Friability test of the tablets of 28 days sample

Initial weight	Weight after rotation	Friability
0.9163	0.9141	0.24%

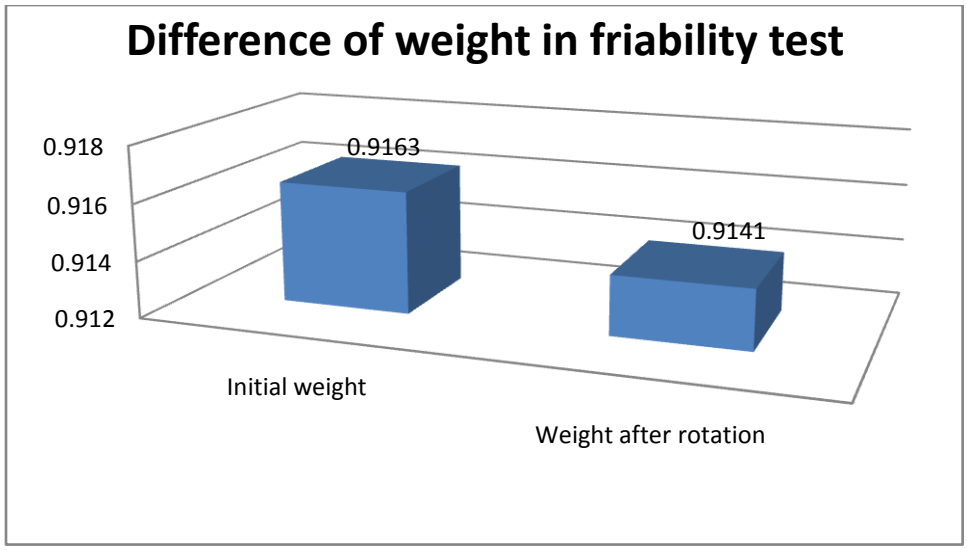

Figure 4.36: Column showing the difference of Initial weight (gm) with Weight after rotation (gm) of the tablets of 28 days sample

4.1.5.5.3 Room temperature stability testing (35 days Sample)

Table 4.32

Friability test of the tablets of 35 days sample

Initial weight (gm)	Weight after rotation (gm)	Friability
0.9093	0.9082	0.12%

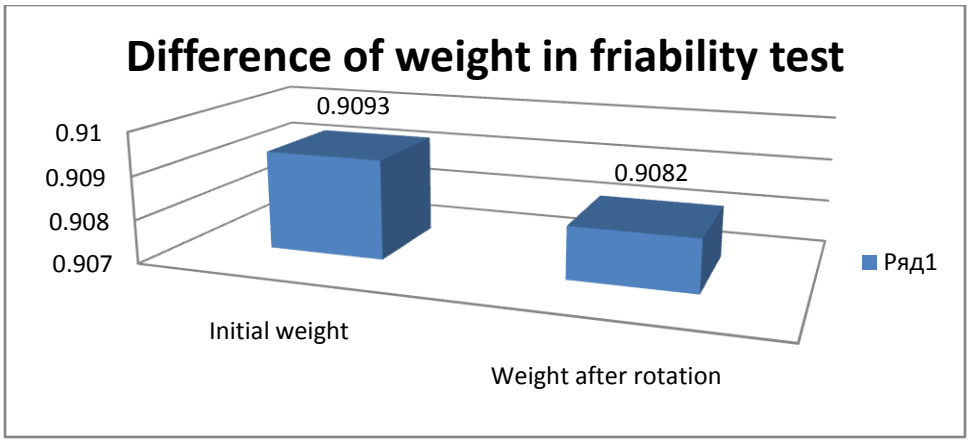

Figure 4.37: Column showing the difference of Initial weight (gm) with Weight after rotation (gm) of the tablets of 35 days sample

4.1.5.5.4 Room temperature stability testing (45 days Sample)

Table 4.33

Friability test of the tablets of 45 days sample

Initial weight (gm)	Weight after rotation (gm)	Friability
0.9146	0.9136	0.07%

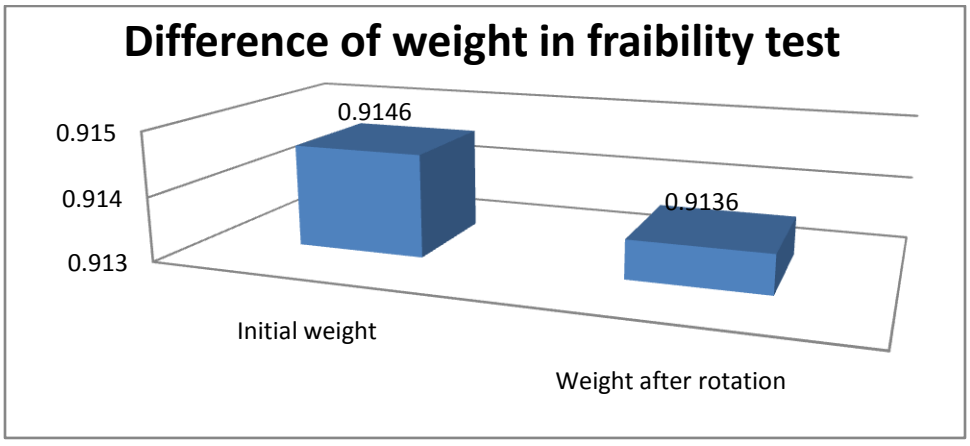

Figure 4.38: Column showing the difference of Initial weight (gm) with Weight after rotation (gm) of the tablets of 45 days sample

From the above esperiment we have found that the sample tablets did not lose more than 1% of their total weight. Thus the test reasult was within the accepted range.

4.1.6 HARDNESS TEST:

The hardness of the tablets was determined by using hardness tester. After determining the Hardness of the individual tablet then we have found the average hardness of the tablet for the control sample.

We have found column diagram where we plot the Hardness (kg) of individual tablet and the Hardness Average (kg) which shows the difference between them for the samples.

4.1.6.1 Control Sample

4.1.6.1.1 Control Sample of 19th February 2012 (Control Sample 1)

Table 4.34

Hardness test of the tablets of Control Sample 1

Tablet no.	Hardness(kg)	Hardness Average (kg)
1	10.3	9.97
2	10.1	
3	9.8	
4	10	
5	10	
6	10.1	
7	10.3	
8	10	
9	9	
10	10.1	

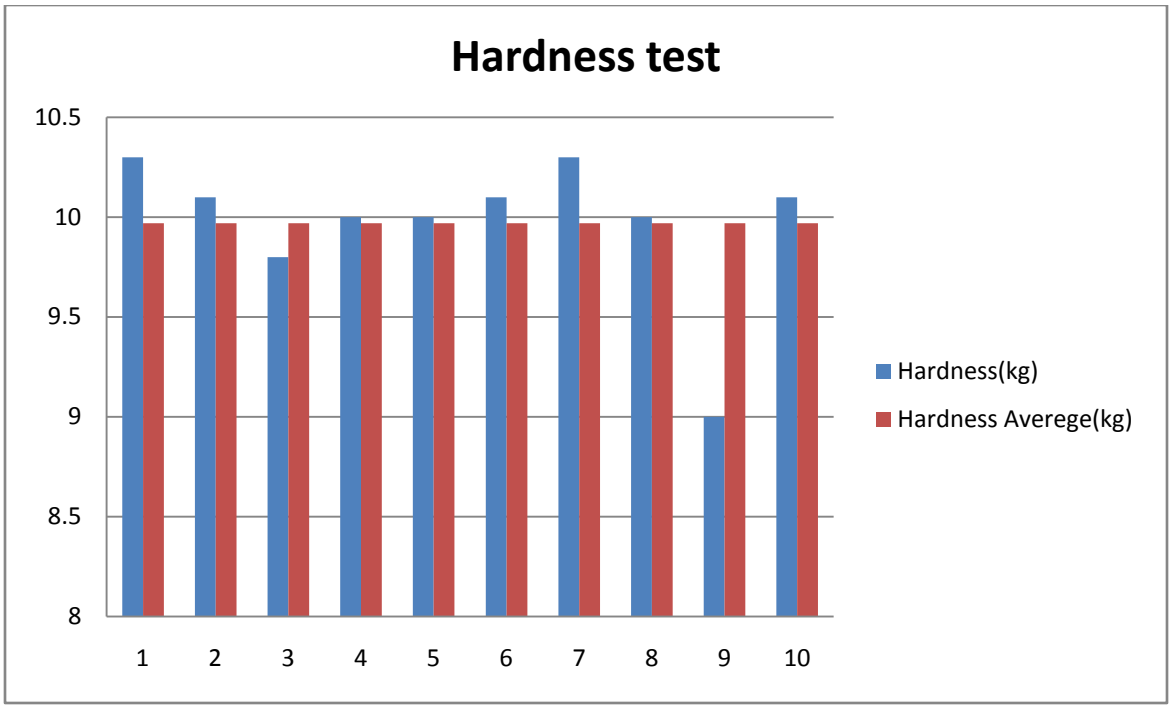

Figure 4.39: Column showing the difference of Hardness (kg) with Hardness Average (kg) of the tablets of Control Sample 1

4.1.6.1.2 Control Sample of 29th March 2012 (Control Sample 2)

Table 4.35:

Hardness test of the tablets of Control Sample 2

Tablet no.	Hardness(kg)	Hardness Average(kg)
1	9.8	9.67
2	9.8	
3	9.4	

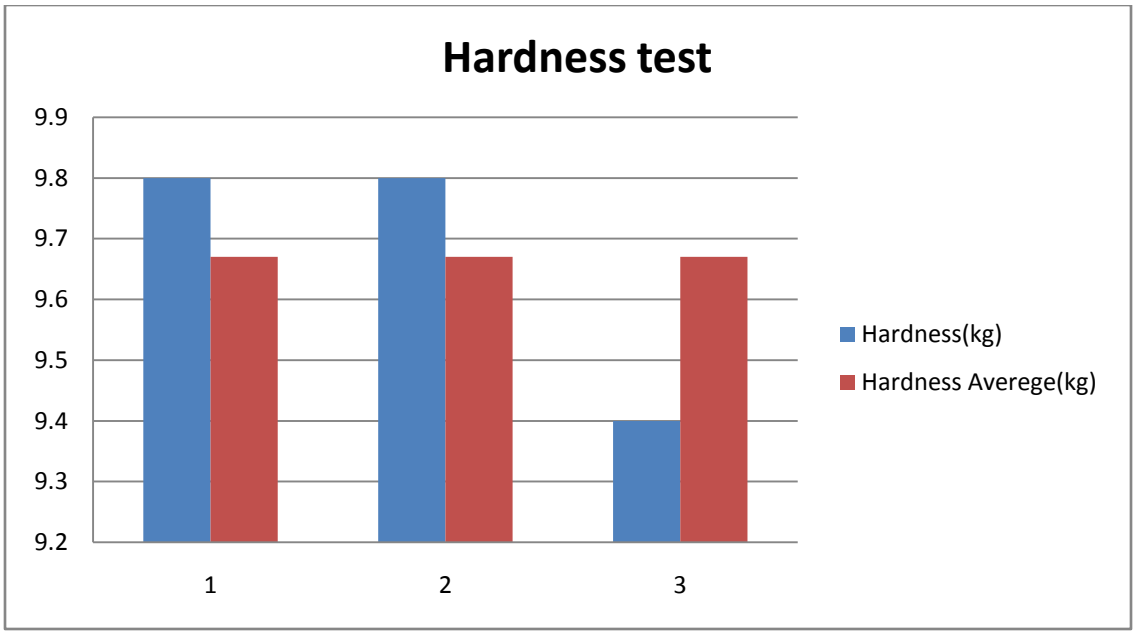

Figure 4.40: Column showing the difference of Hardness (kg) with Hardness Average (kg) of the tablets of Control Sample 2

4.1.6.2 Sample that was kept under 25 watts Electrical Bulb

4.1.6.2.1 Three Hour Sample

Table 4.36

Hardness test of the tablets of three hour sample of 25 watts electrical bulb

Tablet no.	Hardness(kg)	Hardness Average (kg)
1	9.8	9.6
2	10	
3	9	

Figure 4.41: Column showing the difference of Hardness (kg) with Hardness Average (kg) of the tablets of three hour sample of 25 watts electrical bulb

4.1.6.2.2 Six Hour Sample

Table 4.37

Hardness test of the tablets of six hour sample of 25 watts electrical bulb

Tablet no.	Hardness(kg)	Hardness Average(kg)
1	9.9	9.6
2	9.1	
3	9.8	

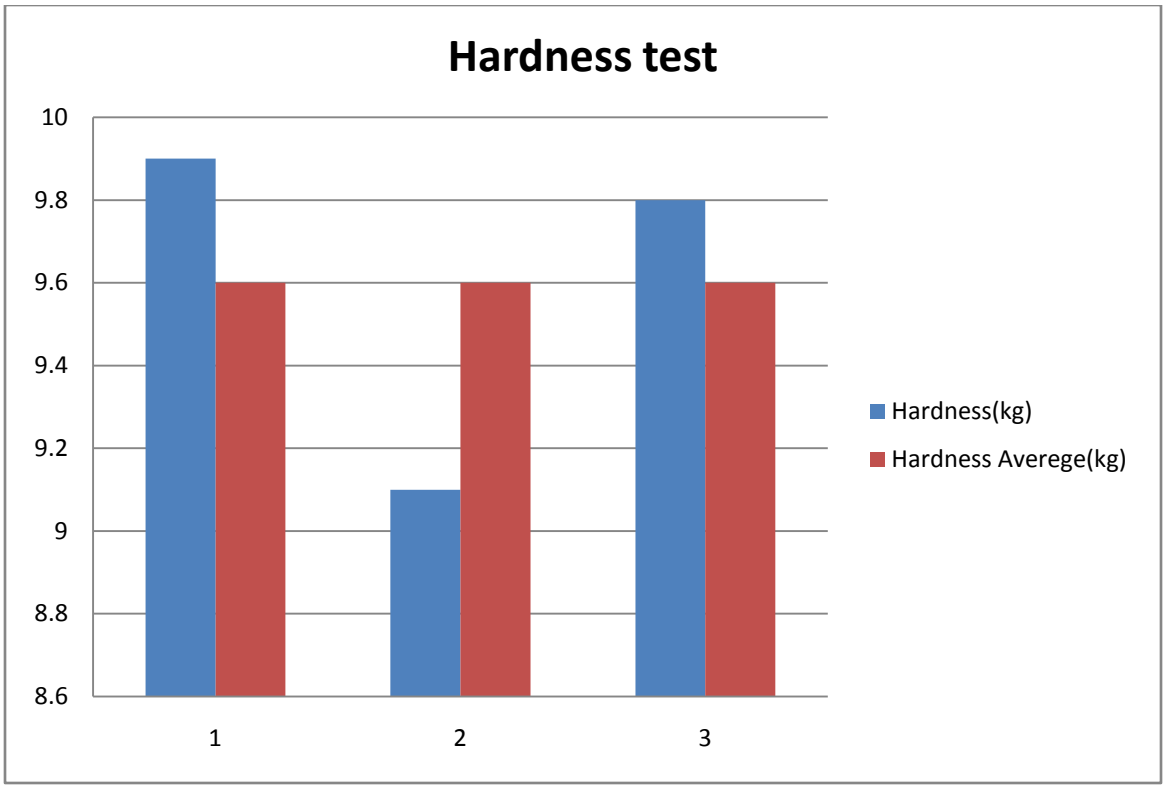

Figure 4.42: Column showing the difference of Hardness (kg) with Hardness Average (kg) of the tablets of six hour sample of 25 watts electrical bulb

4.1.6.2.3 Nine Hour Sample

Table 4.38

Hardness test of the tablets of nine hour sample of 25 watts electrical bulb

Tablet no.	Hardness(kg)	Hardness Average
1	10.2	9.867
2	9.2	
3	10.2	

Figure 4.43: Column showing the difference of Hardness (kg) with Hardness Average (kg) the tablets of nine hour sample of 25 watts electrical bulb

4.1.5.3 Sample that was kept under of 40 watts Electrical Bulb

4.1.6.3.1 Three Hour Sample

Table 4.39

Hardness test of the tablets of three hour sample of 40 watts electrical bulb

Tablet no.	Hardness(kg)	Hardness Average(kg)
1	7.2	
2	6.8	7.06
3	7.2	

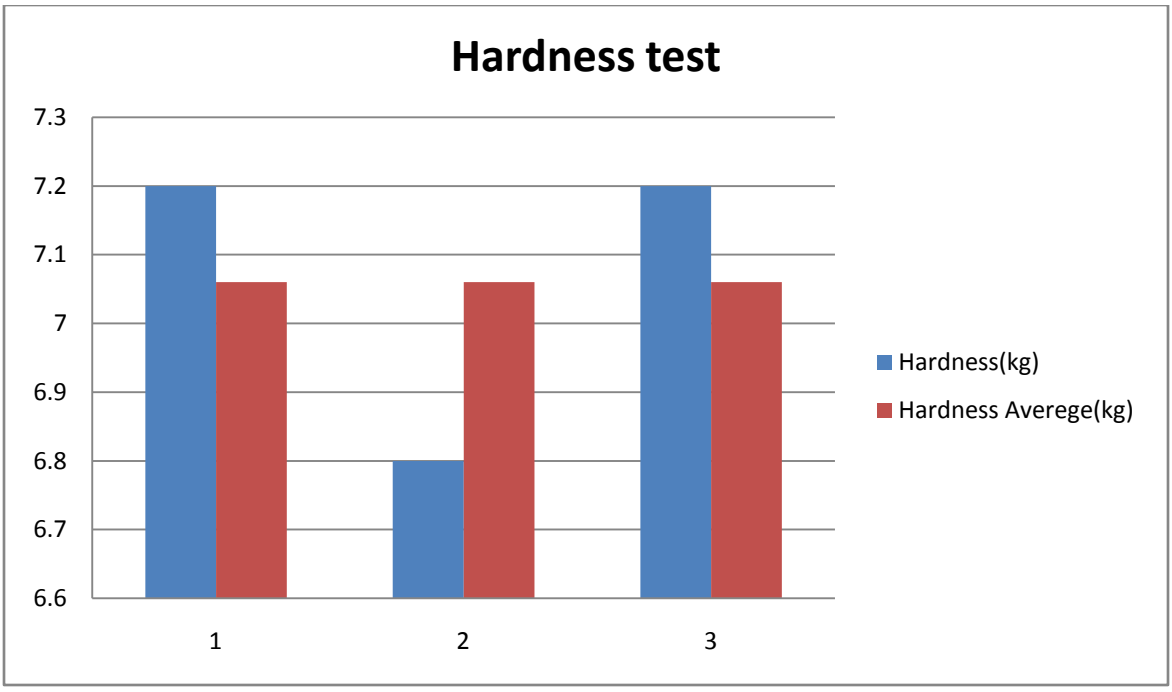

Figure 4.44: Column showing the difference of Hardness (kg) with Hardness Average (kg) the tablets of three hour sample of 40 watts electrical bulb

4.1.6.3.2 Six Hour Sample

Table 4.40

Hardness test of the tablets of six hour sample of 40 watts electrical bulb

Tablet no.	Hardness(kg)	Hardness Average(kg)
1	7.8	8.03
2	8.2	
3	8.1	

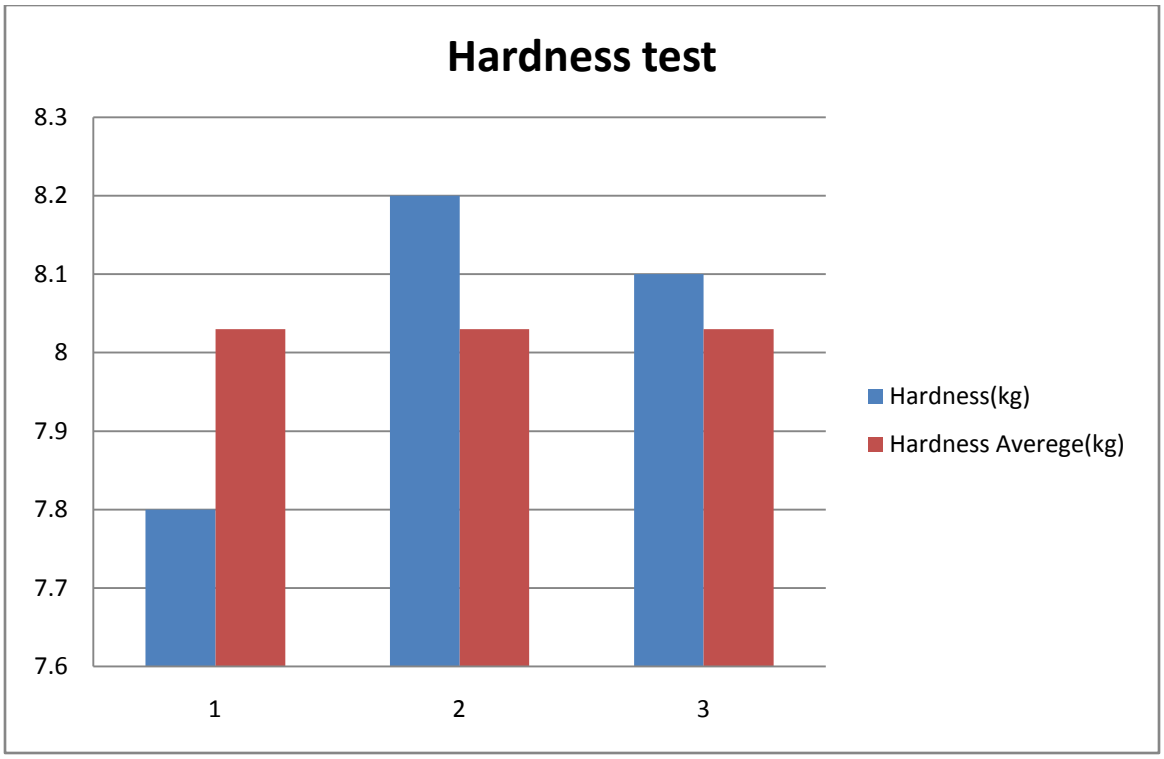

Figure 4.45: Column showing the difference of Hardness (kg) with Hardness Average (kg) of the tablets of six hour sample of 40 watts electrical bulb

4.1.6.3.3 Nine Hour Sample

Table 4.41

Hardness test of the tablets of nine hour sample of 40 watts electrical bulb

Tablet no.	Hardness(kg)	Hardness Average(kg)
1	8.4	
2	7.2	7.67
3	7.4	

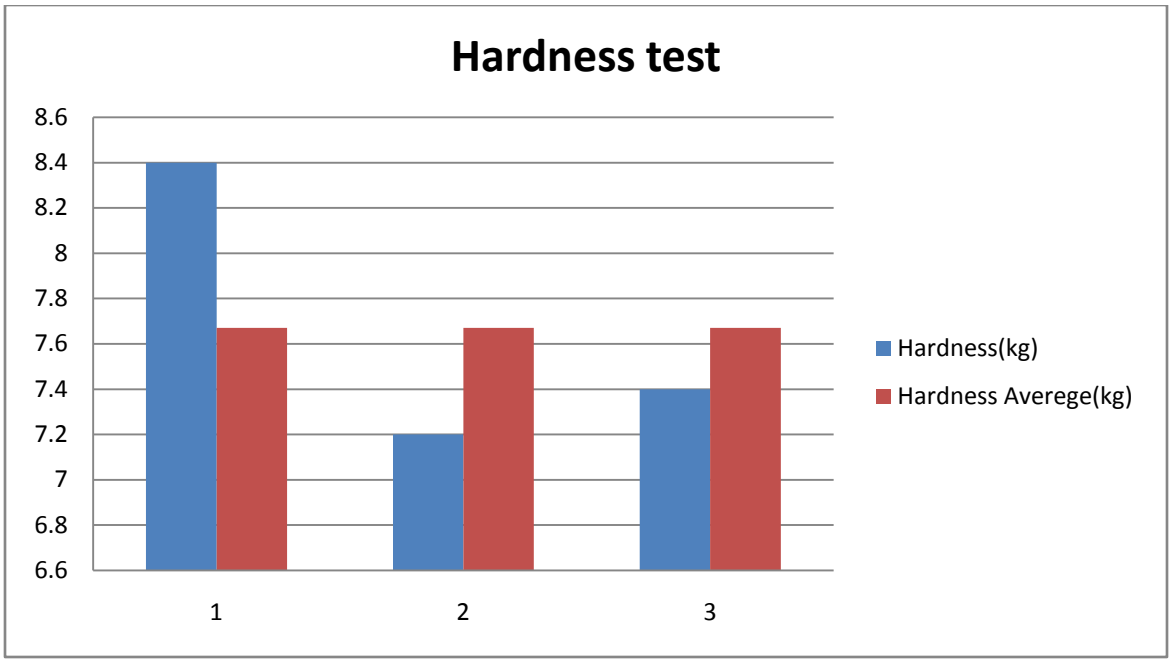

Figure 4.46: Column showing the difference of Hardness (kg) with Hardness Average (kg) of the tablets of nine hour sample of 40 watts electrical bulb

4.1.5.4 Sample that was kept under Sunlight

4.1.6.4.1 Three Hour Sample

Table 4.42

Hardness test of the tablets of three hour sample of sunlight

Tablet no.	Hardness(kg)	Hardness Average(kg)
1	9.3	8.9
2	9.2	
3	8.2	

Figure 4.47: Column showing the difference of Hardness (kg) with Hardness Average (kg) of the tablets of three hour sample of sunlight

4.1.6.4.2 Six Hour Sample

Table 4.43

Hardness test of the tablets of six hour sample of sunlight

Tablet no.	Hardness(kg)	Hardness Average(kg)
1	9.4	
2	9.6	9.2
3	8.8	

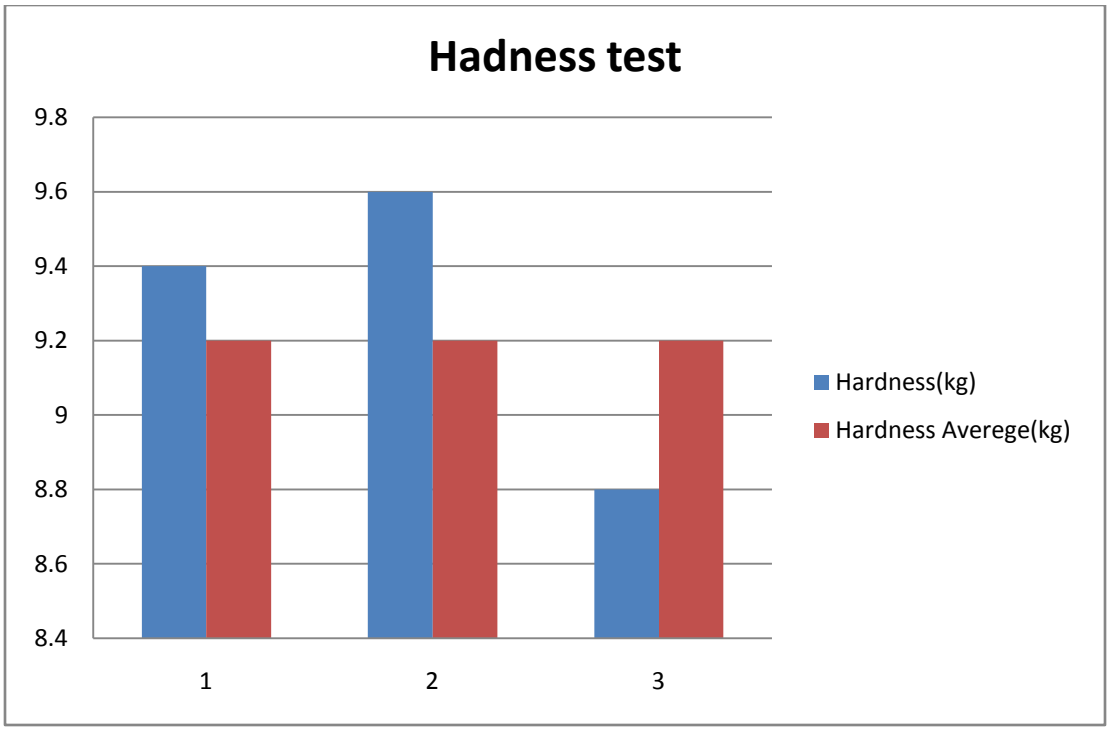

Figure 4.48: Column showing the difference of Hardness (kg) with Hardness Average (kg) of the tablets of six hour sample of sunlight

4.1.6.4.3 Nine Hour Sample

Table 4.44

Hardness test of the tablets of nine hour sample of sunlight

Tablet no.	Hardness(kg)	Hardness Average(kg)
1	9.4	8.867
2	8.8	
3	8.4	

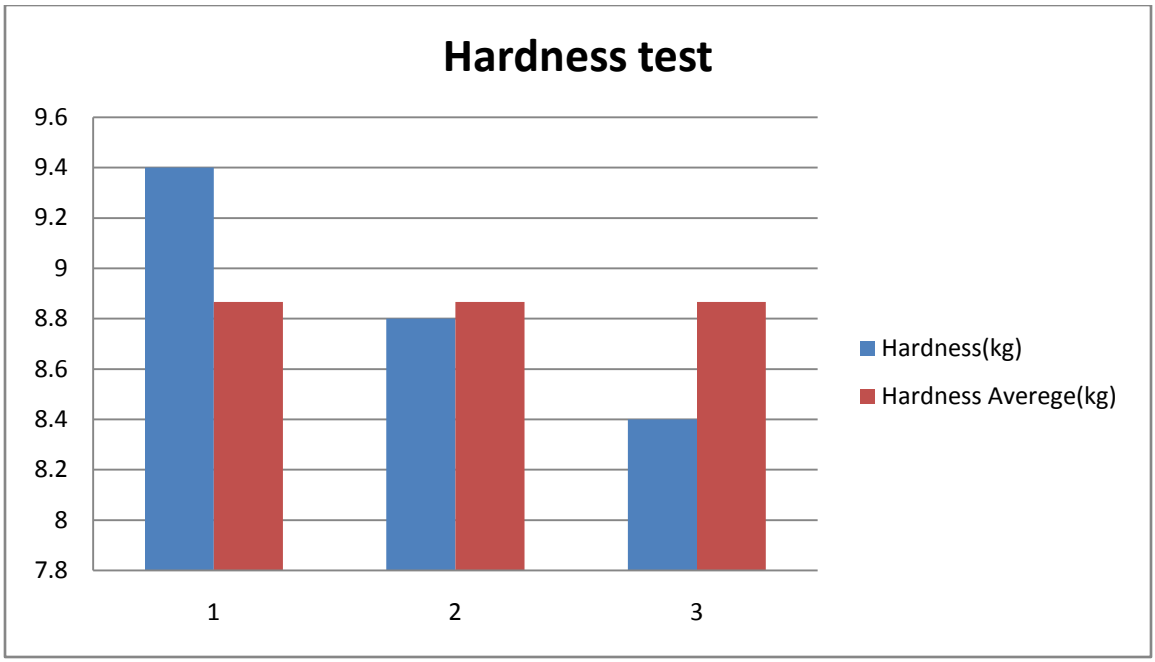

Figure 4.49: Column showing the difference of Hardness (kg) with Hardness Average (kg) of the tablets of nine hour sample of sunlight

4.1.6.5 Sample prepared on Room temperature for stability testing: Preservation of sample started at 23rd February 2012

4.1.6.5.1 Room temperature stability testing (14 days Sample)

Table 4.45

Hardness test of the tablets of 14 days sample

Tablet no.	Hardness(kg)	Hardness Average(kg)
1	9.8	9.467
2	9.2	
3	9.4	

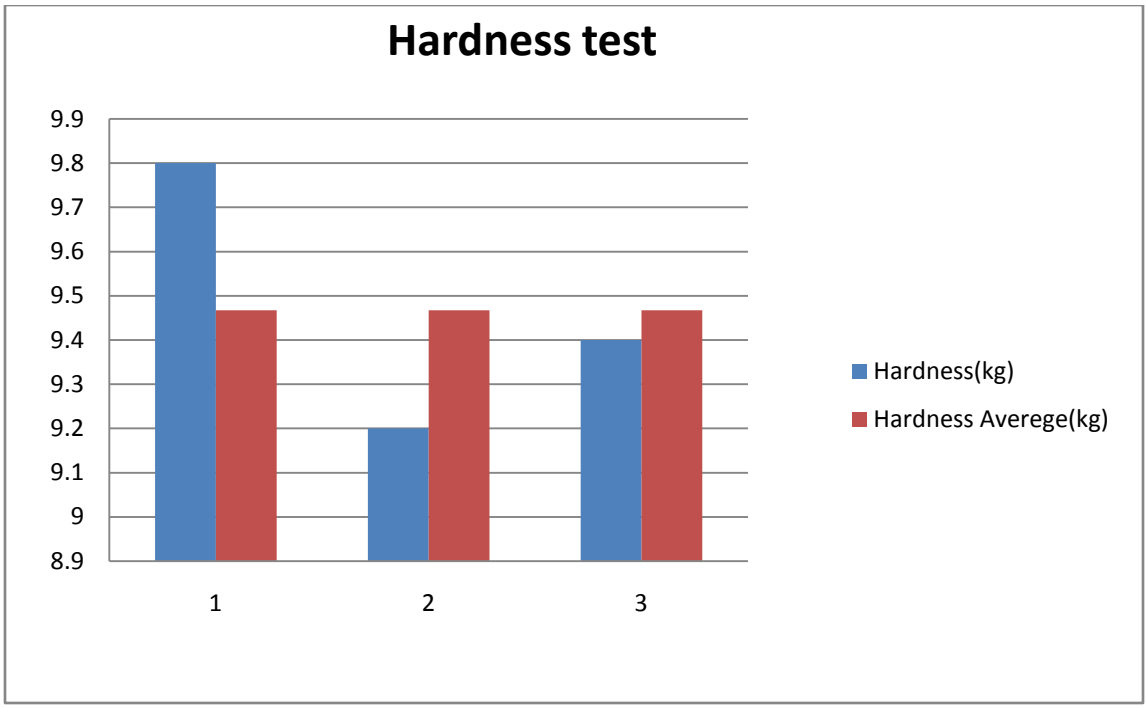

Figure 4.50: Column showing the difference of Hardness (kg) with Hardness Average (kg) of the tablets of 14 days sample

4.1.6.5.2 Room temperature stability testing (28 days Sample)

Table 4.46

Hardness test of the tablets of 28 days sample

Tablet no.	Hardness(kg)	Hardness Average(kg)
1	8	7.43
2	7.4	
3	6.9	

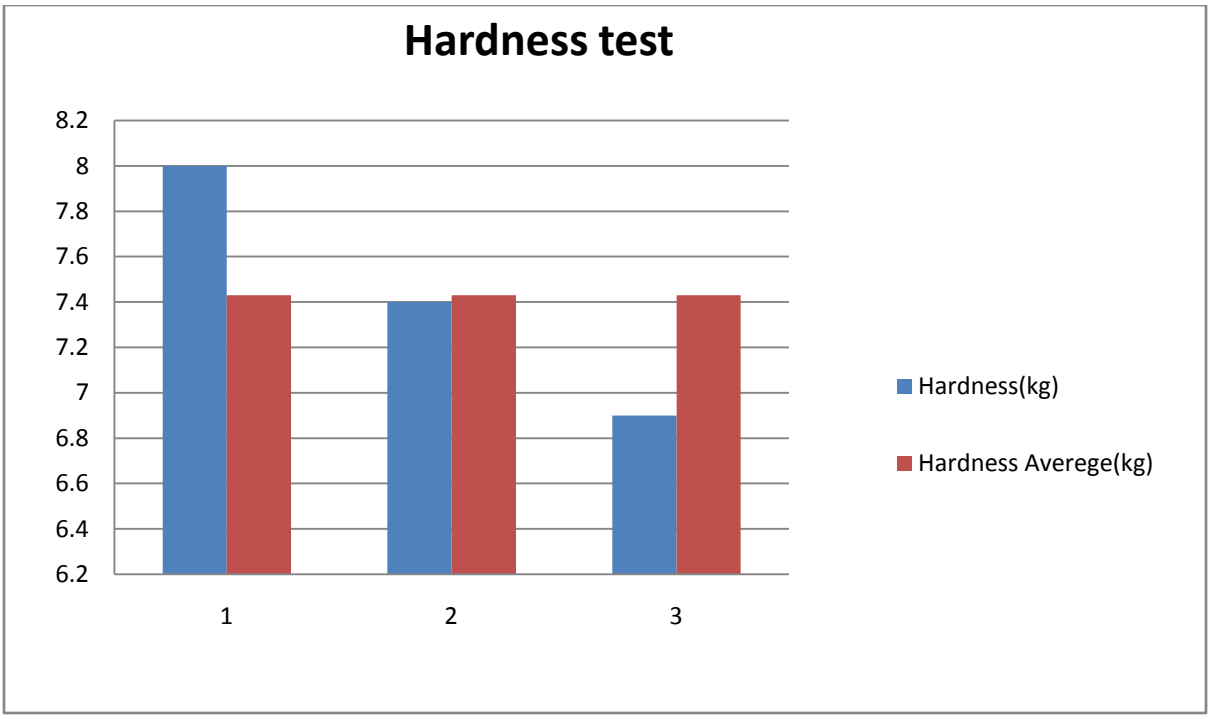

Figure 4.51: Column showing the difference of Hardness (kg) with Hardness Average (kg) of the tablets of 28 days sample

4.1.6.5.3 Room temperature stability testing (35 days Sample)

Table 4.47

Hardness test of the tablets of 35 days sample

Tablet no.	Hardness(kg)	Hardness Average(kg)
1	9.6	9.53
2	9.8	
3	9.2	

Figure 4.52: Column showing the difference of Hardness (kg) with Hardness Average (kg) of the tablets of 35 days sample

4.1.6.5.4 Room temperature stability testing (45 days Sample)

Table 4.48

Hardness test of the tablets of 45 days sample

Tablet no.	Hardness(kg)	Hardness Average(kg)
1	8	8.167
2	8.4	
3	8.1	

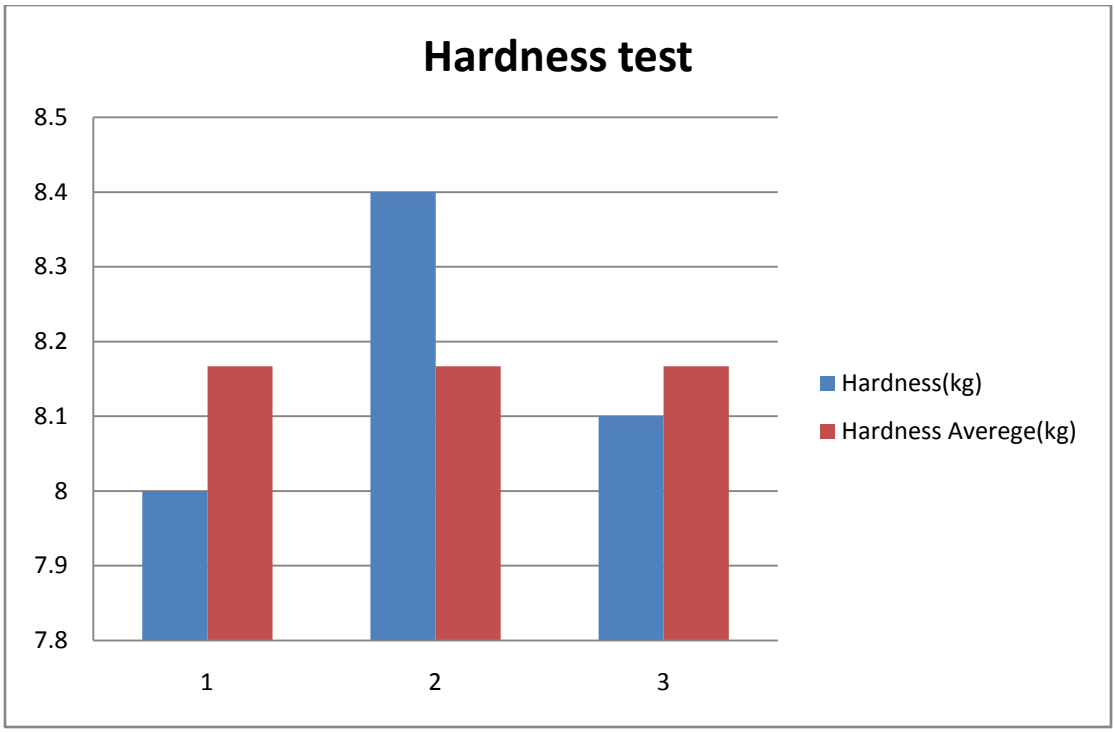

Figure 4.53: Column showing the difference of Hardness (kg) with Hardness Average (kg) of the tablets of 45 days sample

We have found that the hardness of the sample tablets reduced every time due to the exposure of light.

4.1.7 POTENCY DETERMINATION BY UV SPECTROSCOPY

We have found different absorption for different concentration of Flupentixol dihydrochloride and Melitracen hydrochloride on the tablet solution.

We got a straight line by plotting the concentration against the absorbance for the Flupentixol dihydrochloride and Melitracen hydrochloride on the tablet solution.

4.1.7.1 Control Sample

4.1.7.1.1 Control Sample of 19th February 2012 (Control Sample 1)

4.1.7.1.1.1 Flupentixol dihydrochloride

Table 4.49

Concentration and Absorbance of Flupentixol dihydrochloride of Control Sample 1

Concentration (mg/ml)	Absorbance at 229 nm
0.429	0.414

4.1.7.1.1.2 Melitracen hydrochloride

Table 4.50

Concentration and Absorbance of Melitracen hydrochloride of Control Sample 1

Concentration (mg/ml)	Absorbance at 258 nm
9.53	0.428

4.1.7.1.2 Control Sample of 29th March 2012 (Control Sample 2)

4.1.7.1.2.1 Flupentixol dihydrochloride

Table 4.51

Concentration and Absorbance of Flupentixol dihydrochloride Control Sample 2

Concentration (mg/ml)	Absorbance at 229 nm
0. 557	0.584

4.1.7.1.2.2 Melitracen hydrochloride

Table 4.52

Concentration and Absorbance of Melitracen hydrochloride Control Sample 2

Concentration (mg/ml)	Absorbance at 258 nm
10.02	0.450

4.1.7.3 Sample that was kept under 25 watts Electrical Bulb

4.1.7.3.1 Flupentixol dihydrochloride (Three Hour Sample)

Table 4.53

Concentration and Absorbance of Flupentixol dihydrochloride of three hour sample of 25 watts electrical bulb

Concentration (mg/ml)	Absorbance at 229 nm
0.72647	0.726

4.1.7.3.2 Melitracen hydrochloride (Three Hour Sample)

Table 4.54

Concentration and Absorbance of Melitracen hydrochloride of three hour sample of 25 watts electrical bulb

Concentration (mg/ml)	Absorbance at 258 nm
10.1	0.454

4.1.7.3.3 Flupentixol dihydrochloride (Six Hour Sample)

Table 4.55

Concentration and Absorbance of Flupentixol dihydrochloride of six hour sample of 25 watts electrical bulb

Concentration (mg/ml)	Absorbance at 229 nm
0.549	0.545

4.1.7.3.4 Melitracen hydrochloride (Six Hour Sample)

Table 4.56

Concentration and Absorbance of Melitracen hydrochloride of six hour sample of 25 watts electrical bulb

Concentration (mg/ml)	Absorbance at 258 nm
9.7	0.436

4.1.7.3.5 Flupentixol dihydrochloride (Nine Hour Sample)

Table 4.57

Concentration and Absorbance of Flupentixol dihydrochloride of nine hour sample of 25 watts electrical bulb

Concentration (mg/ml)	Absorbance at 229 nm
0.527	0.523

4.1.7.3.6 Melitracen hydrochloride (Nine Hour Sample)

Table 4.58

Concentration and Absorbance of Melitracen hydrochloride of nine hour sample of 25 watts electrical bulb

Concentration (mg/ml)	Absorbance at 258 nm
9.125	0.41

4.1.7.4 Difference in Concentration and Absorbance in each 3 Hour time interval for Sample that was kept under of 25 watts Electrical Bulb

4.1.7.4.1 Flupentixol dihydrochloride

We have found different absorption for different concentration of Flupentixol dihydrochloride in each 3 Hour time interval for sample which was kept under the 25 watts electrical bulb and we have seen that the concentration of Flupentixol dihydrochloride was declined in each three hour time interval.

Table 4.59

Difference in Concentration and Absorbance in each 3 Hour time interval for Flupentixol dihydrochloride of 25 watts electrical bulb sample

Time	Concentration (mg/ml)	Absorbance at 229 nm
3 Hours	0.72647	0.726
6 Hours	0.549	0.545
9 Hours	0.527	0.523

In here, we have found column diagram where we have seen that concentration of Flupentixol dihydrochloride decreases in each three hour time interval.

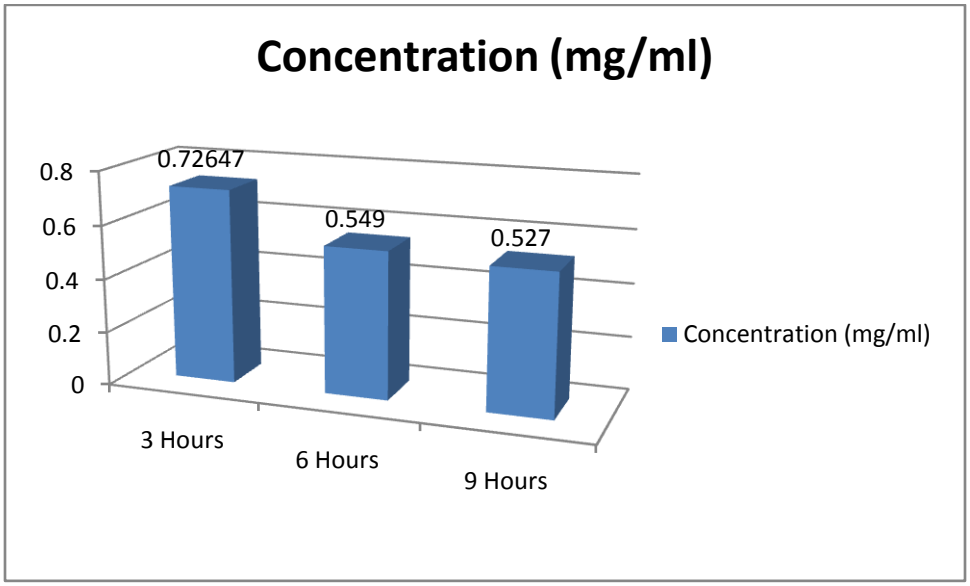

Figure 4.54: Column showing the difference in Concentration after each 3 Hour time interval for Flupentixol dihydrochloride of 25 watts electrical bulb sample

4.1.7.4.2 Melitracen hydrochloride

We have found different absorption for different concentration of Melitracen hydrochloride in each 3 Hour time interval for sample which was kept under the 25 watts electrical bulb and we have seen that the concentration of Flupentixol dihydrochloride was declined in each three hour time interval.

Table 4.60

Difference in Concentration and Absorbance in each 3 Hour time interval for Melitracen hydrochloride of 25 watts electrical bulb sample

Time	Concentration (mg/ml)	Absorbance at 258 nm
3 Hours	10.1	0.454
6Hours	9.7	0.436
9 Hours	9.125	0.41

In here, we have found column diagram where we have seen that concentration Melitracen hydrochloride decreases in each three hour time interval.

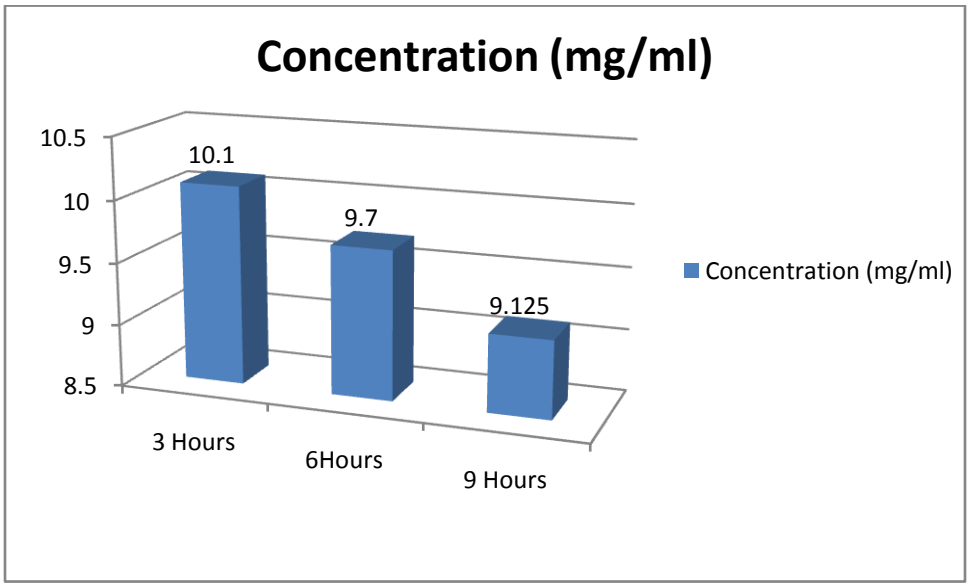

Figure 4.55: Column showing the difference in Concentration after each 3 Hour time interval for Melitracen hydrochloride of 25 watts electrical bulb sample

4.1.7.5 Sample that was kept under of 40 watts Electrical Bulb

4.1.7.5.1 Flupentixol dihydrochloride (Three Hour Sample)

Table 4.61

Concentration and Absorbance of Flupentixol dihydrochloride of three hour sample of 40 watts electrical bulb

Concentration (mg/ml)	Absorbance at 229 nm
0.36	0.355

4.1.7.5.2 Melitracen hydrochloride (Three Hour Sample)

Table 4.62

Concentration and Absorbance of Melitracen hydrochloride of three hour sample of 40 watts electrical bulb

Concentration (mg/ml)	Absorbance at 258 nm
10.1	0.455

4.1.7.5.3 Flupentixol dihydrochloride (Six Hour Sample)

Table 4.63

Concentration and Absorbance of Flupentixol dihydrochloride of six hour sample of 40 watts electrical bulb

Concentration (mg/ml)	Absorbance at 229 nm
0.312	0.304

4.1.7.5.4 Melitracen hydrochloride (Six Hour Sample)

Table 4.64

Concentration and Absorbance of Melitracen hydrochloride of six hour sample of 40 watts electrical bulb

Concentration (mg/ml)	Absorbance at 258 nm
9.05	0.407

4.1.7.5.5 Flupentixol dihydrochloride (Nine Hour Sample)

Table 4.65

Concentration and Absorbance of Flupentixol dihydrochloride of nine hour sample of 40 watts electrical bulb

Concentration (mg/ml)	Absorbance at 229 nm
0.248	0.238

4.1.7.5.6 Melitracen hydrochloride (Nine Hour Sample)

Table 4.66

Concentration and Absorbance of Melitracen hydrochloride of nine hour sample of 40 watts electrical bulb

Concentration (mg/ml)	Absorbance at 258 nm
7.94	0.357

4.1.7.6 Difference in Concentration and Absorbance in each 3 Hour time interval for Sample that was kept under of 40 watts Electrical Bulb

4.1.7.6.1 Flupentixol dihydrochloride

We have found different absorption for different concentration of Flupentixol dihydrochloride in each 3 Hour time interval for sample which was kept under the 40 watts electrical bulb and we have seen that the concentration of Flupentixol dihydrochloride was declined in each three hour time interval.

Table 4.67

Difference in Concentration and Absorbance in each 3 Hour time interval for Flupentixol dihydrochloride of 40 watts electrical bulb sample

Time	Concentration (mg/ml)	Absorbance at 229 nm
3 Hours	0.36	0.355
6Hours	0.312	0.304
9 Hours	0.248	0.238

In here, we have found column diagram where we have seen that concentration of Flupentixol dihydrochloride in each three hour time interval.

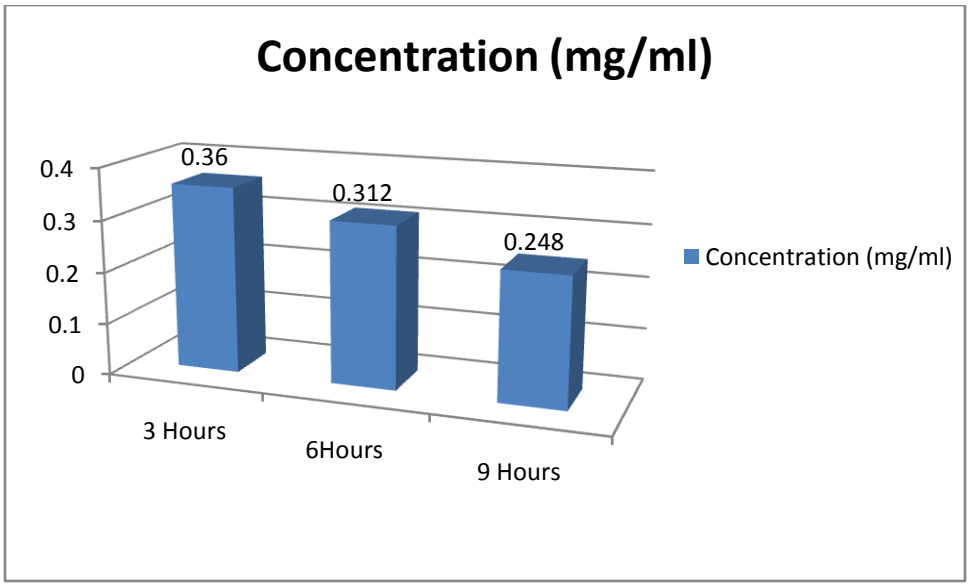

Figure 4.56: Column showing the difference in Concentration after each 3 Hour time interval for Flupentixol dihydrochloride of 40 watts electrical bulb sample

4.1.7.6.2 Melitracen hydrochloride

We have found different absorption for different concentration of Melitracen hydrochloride in each 3 Hour time interval for sample which was kept under the 40 watts electrical bulb and we have seen that the concentration of Flupentixol dihydrochloride was declined in each three hour time interval.

Table 4.68

Difference in Concentration and Absorbance in each 3 Hour time interval for Melitracen hydrochloride of 40 watts electrical bulb sample

Time	Concentration (mg/ml)	Absorbance at 258 nm
3 Hours	10.1	0.455
6Hours	9.05	0.407
9 Hours	7.94	0.357

In here, we have found column diagram where we have seen that concentration Melitracen hydrochloride decreases in each three hour time interval.

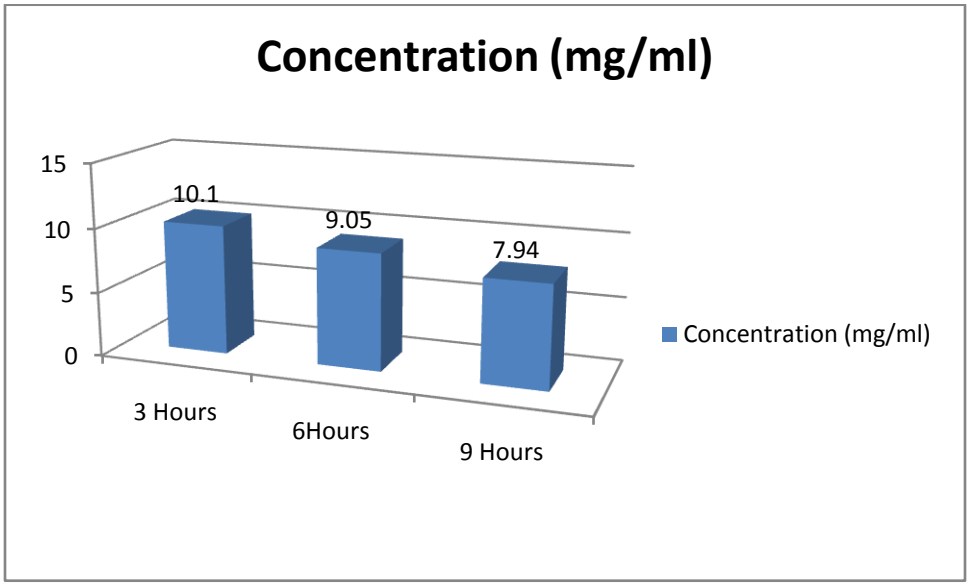

Figure 4.57: Column showing the difference in Concentration after each 3 Hour time interval for Melitracen hydrochloride of 40 watts electrical bulb sample

4.1.6.7 Sample that was kept under Sunlight

4.1.7.7.1 Flupentixol dihydrochloride (Three Hour Sample)

Table 4.69

Concentration and Absorbance of Flupentixol dihydrochloride of three hour sample of sunlight

Concentration (mg/ml)	Absorbance at 229 nm
0.5549	0.551

4.1.7.7.2 Melitracen hydrochloride (Three Hour Sample)

Table 4.70

Concentration and Absorbance of Melitracen hydrochloride of three hour sample of sunlight

Concentration (mg/ml)	Absorbance at 258 nm
10.06	0.452

4.1.7.7.3 Flupentixol dihydrochloride (Six Hour Sample)

Table 4.71

Concentration and Absorbance of Flupentixol dihydrochloride of six hour sample of sunlight

Concentration (mg/ml)	Absorbance at 229 nm
0.538	0.534

4.1.7.7.4 Melitracen hydrochloride (Six Hour Sample)

Table 4.72

Concentration and Absorbance of Melitracen hydrochloride of six hour sample of sunlight

Concentration (mg/ml)	Absorbance at 258 nm
9.639	0.433

4.1.7.7.5 Flupentixol dihydrochloride (Nine Hour Sample)

Table 4.73

Concentration and Absorbance of Flupentixol dihydrochloride of nine hour sample of sunlight

Concentration (mg/ml)	Absorbance at 229 nm
0.523	0.518

4.1.7.7.6 Melitracen hydrochloride (Nine Hour Sample)

Table 4.74

Concentration and Absorbance of Melitracen hydrochloride of nine hour sample of sunlight

Concentration (mg/ml)	Absorbance at 258 nm
9.282	0.417

4.1.7.8 Difference in Concentration and Absorbance in each 3 Hour time interval for Sample that was kept under Sunlight

4.1.7.8.1 Flupentixol dihydrochloride

We have found different absorption for different concentration of Flupentixol dihydrochloride in each 3 Hour time interval for sample which was kept under the sunlight and we have seen that the concentration of Flupentixol dihydrochloride was declined in each three hour time interval.

Table 4.75

Difference in Concentration and Absorbance in each 3 Hour time interval for Flupentixol dihydrochloride of sunlight sample

Time	Concentration (mg/ml)	Absorbance at 229 nm
3 Hours	0.5549	0.551
6Hours	0.538	0.534
9 Hours	0.523	0.518

In here, we have found column diagram where we have seen that concentration of Flupentixol dihydrochloride decreases in each three hour time interval.

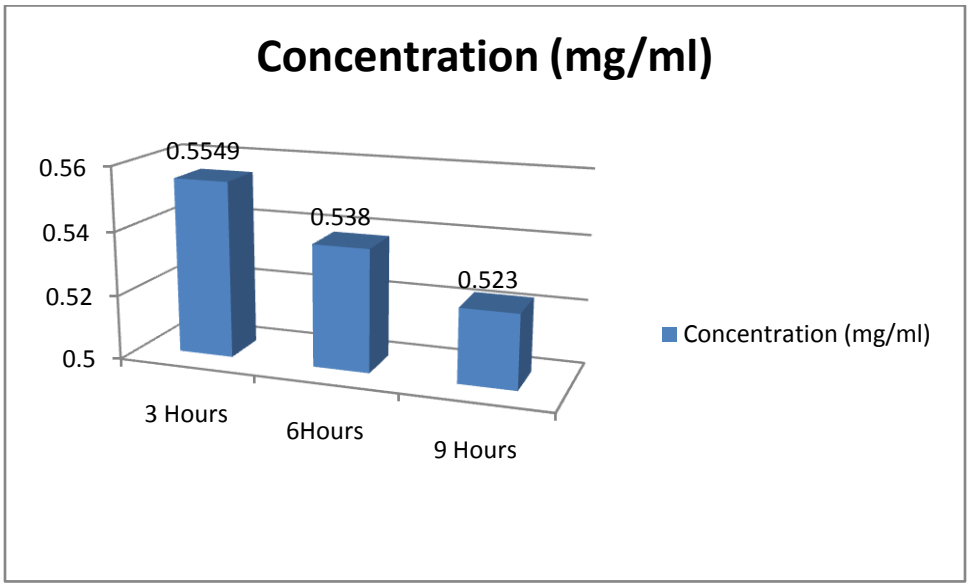

Figure 4.58: Column showing the difference in Concentration after each 3 Hour time interval for Flupentixol dihydrochloride of sunlight sample

4.1.7.8.2 Melitracen hydrochloride

We have found different absorption for different concentration of Melitracen hydrochloride in each 3 Hour time interval for sample which was kept under the sunlight and we have seen that the concentration of Flupentixol dihydrochloride was declined in each three hour time interval.

Table 4.76

Difference in Concentration and Absorbance in each 3 Hour time interval for Melitracen hydrochloride of sunlight sample

Time	Concentration (mg/ml)	Absorbance at 258 nm
3 Hours	10.06	0.452
6 Hours	9.639	0.433
9Hours	9.282	0.417

In here, we have found column diagram where we have seen that concentration Melitracen hydrochloride decreases in each three hour time interval.

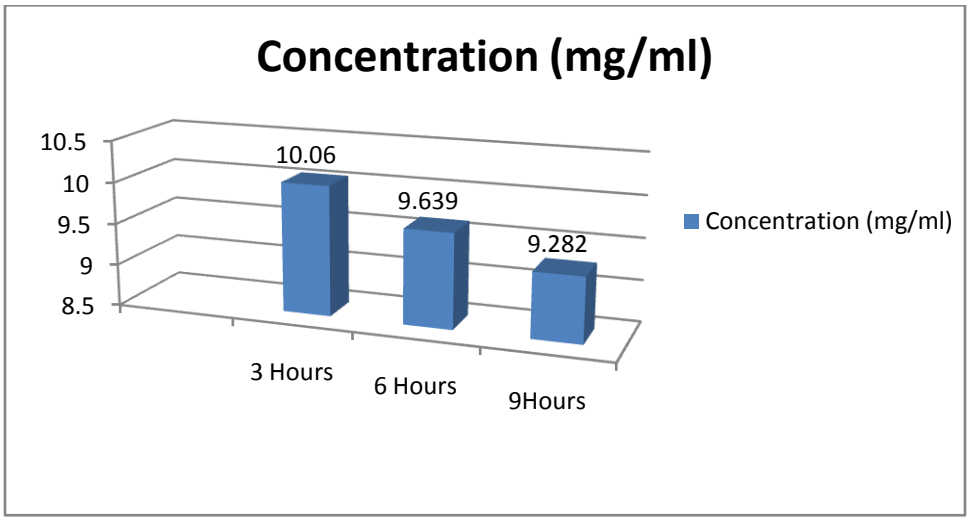

Figure 4.59: Column showing the difference in Concentration after each 3 Hour time interval for Melitracen hydrochloride of sunlight sample

4.1.7.9 Sample prepared on Room temperature for stability testing

4.1.7.9.1 Flupentixol dihydrochloride (14 days Sample)

Table 4.77

Concentration and Absorbance of Flupentixol dihydrochloride of 14 days sample

Concentration (mg/ml)	Absorbance at 229 nm
0.373	0.345

4.1.7.9.2 Melitracen hydrochloride (14 days Sample)

Table 4.78

Concentration and Absorbance of Melitracen hydrochloride of 14 days sample

Concentration (mg/ml)	Absorbance at 258 nm
9.93	0.446

4.1.7.9.3 Flupentixol dihydrochloride (28 days Sample)

Table 4.79

Concentration and Absorbance of Flupentixol dihydrochloride of 28 days sample

Concentration (mg/ml)	Absorbance at 229 nm
0.348	0.34

4.1.7.9.4 Melitracen hydrochloride (28 days Sample)

Table 4.80

Concentration and Absorbance of Melitracen hydrochloride of 28 days sample

Concentration (mg/ml)	Absorbance at 258 nm
8.12	0.365

4.1.7.9.5 Flupentixol dihydrochloride (35 days Sample)

Table 4.81

Concentration and Absorbance of Flupentixol dihydrochloride of 35 days sample

Concentration (mg/ml)	Absorbance at 229 nm
0.3324	0.324

4.1.7.9.6 Melitracen hydrochloride (35 days Sample)

Table 4.82

Concentration and Absorbance of Melitracen hydrochloride of 35 days sample

Concentration (mg/ml)	Absorbance at 258 nm
9.79	0.44

4.1.7.9.7 Flupentixol dihydrochloride (45 days Sample)

Table 4.83

Concentration and Absorbance of Flupentixol dihydrochloride of 45 days sample

Concentration (mg/ml)	Absorbance at 229 nm
0.25	0.24

4.1.7.9.8 Melitracen hydrochloride (45 days Sample)

Table 4.84

Concentration and Absorbance of Melitracen hydrochloride of 45 days sample

Concentration (mg/ml)	Absorbance at 258 nm
7.36	0.331

4.1.7.10 Difference in Concentration and Absorbance for the Sample prepared on Room temperature for stability testing

4.1.7.10.1 Flupentixol dihydrochloride

We have found different absorption for different concentration of Flupentixol dihydrochloride in each time interval and we have seen that the concentration of Flupentixol dihydrochloride was declined every time.

Table 4.85

Difference in Concentration and Absorbance in definite time interval for Flupentixol dihydrochloride of room temperature sample

Time	Concentration (mg/ml)	Absorbance at 229 nm
14 days	0.373	0.345
28days	0.348	0.34
35 days	0.3324	0.324
45 days	0.25	0.24

In here, we have found column diagram where we have seen that concentration of Flupentixol dihydrochloride decreases in each three hour time interval.

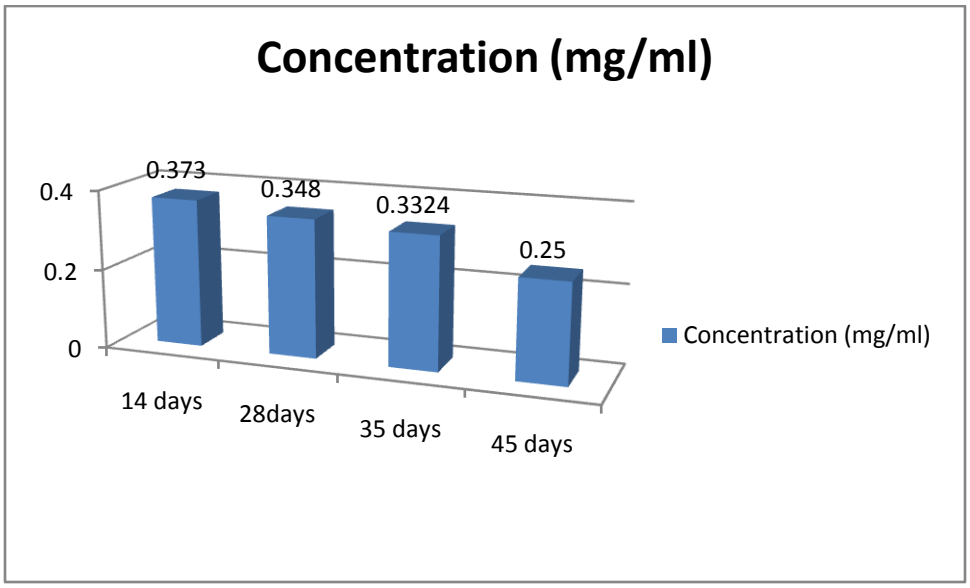

Figure 4.60: Column showing the difference in Concentration in definite time interval for Flupentixol dihydrochloride of room temperature sample

4.1.7.10.2 Melitracen hydrochloride

We have found different absorption for different concentration of Melitracen hydrochloride in each time interval and we have seen that the concentration of Flupentixol dihydrochloride was declined every time.

Table 4.86

Difference in Concentration and Absorbance in definite time interval for Melitracen hydrochloride of room temperature sample

Time	Concentration (mg/ml)	Absorbance at 258 nm
14 days	9.93	0.446
28days	8.12	0.365
35 days	9.79	0.44
45 days	7.36	0.331

In here, we have found column diagram where we have seen that concentration Melitracen hydrochloride decreases in each time interval. Although the concentration of 35 days sample increases here but every other test we have seen it to be decreased.

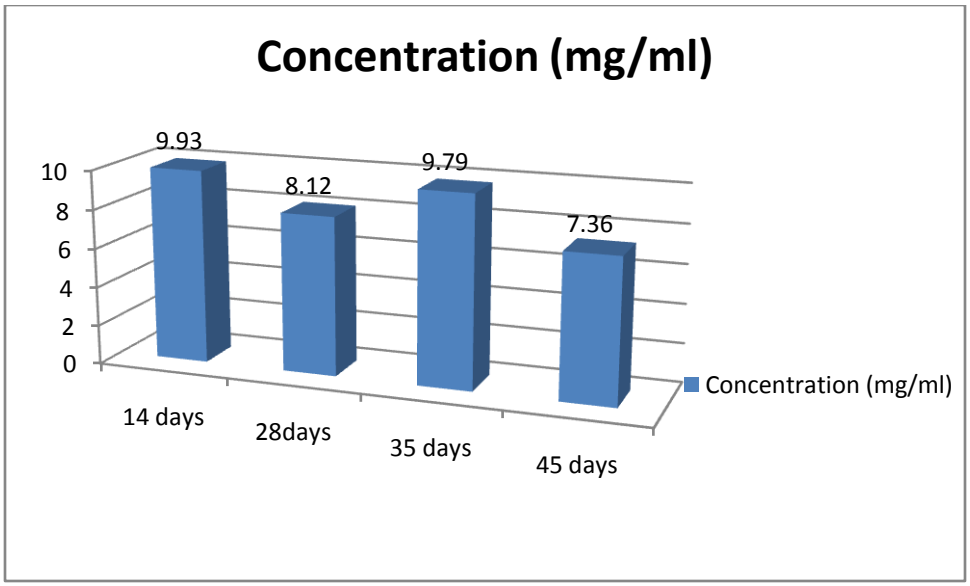

Figure 4.61: Column showing the difference in Concentration in definite time interval for Melitracen hydrochloride of room temperature sample

From the above experiment we have found that the concentration of Flupentixol dihydrochloride and Melitracen hydrochloride was decreased gradually in every light exposure even in the normal room temperature condition.

4.2 DISCUSSION

In our experiment we have found that the concentration (mg/ml) of Flupentixol dihydrochloride and Melitracen hydrochloride was decreased due to exposure of light but in all other physical parameter tests we did not found any major change. All the result of physical parameter tests was within the acceptable range.

4.3 CONCLUSION

In our experiment we have found that the concentration (mg/ml) of Flupentixol dihydrochloride and Melitracen hydrochloride was decreased in gradual light exposure. We have seen that the concentration (mg/ml) of Flupentixol dihydrochloride and Melitracen hydrochloride were less in the three hour light exposed sample than control samples which were not exposed to light, six and nine hour light exposed samples has more less concentration (mg/ml) of Flupentixol dihydrochloride and Melitracen hydrochloride than the three hour light exposed sample.

We also have found the same result for the sample which was kept on the normal room temperature light exposed condition. We have seen that the concentration (mg/ml) of Flupentixol dihydrochloride and Melitracen hydrochloride were less in the 28, 35 and 45 days sample than the 14 days sample.

Thus from this experiment we assume that the Flupentixol dihydrochloride and Melitracen hydrochloride combination product is light sensitive.

Chapter Five

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