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## Formulation and Evaluation of Hard Vegetable Capsule for Healthy Brain Using Powder of Green Tea and Brahmi Extract



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HUMAN

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### ABSTRACT

In recent era, vegetable capsules are new approach which might be replaced the usage of gelatin or non-vegetable capsule. The present work efforts have been made to prepare Green Tea and Brahmi extract powder hard vegetable capsule by manual filling machine. Dissolution Study drugs complete release time was 90 min. and capsule 4<sup>th</sup> found to be best because it shows maximum drug release 99%. Stability Study of all the evaluation parameters was again studied in 30, 60 and 90 days, means in the interval of 30 days a month and the result found that all the parameters were in the standard range, it means drugs are stable. The combination of Green Tea and Brahmi Extract powder had prepared and all parameters of evaluation and Preformulation were studied both drugs found compatible with each other, and they pass all test at various conditions. This is a best Nutraceutical diet and supplements for the women's and children's, in which green tea gives a lot of health benefits meanwhile Brahmi strengthen the memory enhancement and brain capacity, and avoids a lots of nervous system problems.



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## INTRODUCTION

In recent era, vegetable capsules are new approach which might be replaced the usage of gelatin or non-vegetable capsule. Hydroxy propyl methyl cellulose mainly used in manufacturing of such kind of capsule cell. It is also used for weight loss and to treat stomach disorder vomiting diarrhea and prevent various cancer including breast cancer, gastric cancer. It is used for crown's disease, Parkinson's disease. Disease of the heart and blood vessels and other used in the anti-depressant, anti-dementia, antioxidant, anti-ulcerative [1-5]. The present work deal with the preparation and evaluation of green tea botanical name *Camellia sinensis* (Family: Theaceae), Fig.1, and Brahmi botanical name, *Bacopa monnieri* (Family- Plantaginaceae), Fig. 1, extract powder hard vegetable capsule in which starch were used in the excipient and HPMC capsule shell.

Chinese *Camellia sinensis* is native to mainland China, South and Southeast Asia; the flowers are yellow-white, 2.5-4cm in diameter, with 7 to 8 petals. The leaves are 4-15cm long and 2-5cm broad. The cardinal antioxidative ingredient in the green tea extract is green tea catechins (GTC), which comprise four major epicatechin derivatives; namely, epicatechin (EC), epigallocatechin (EGC), epicatechin gallate (ECG), and epigallocatechin gallate (EGCG). The leaves of brahmi are succulent, oblong and 4–6 mm (0.16–0.24 in) thick. Leaves are oblanceolate and are arranged oppositely on the stem. The flowers are small and white, with four or five petals. Its ability to grow in water makes it a popular aquarium plant. It can even grow in slightly brackish conditions. The best characterized compounds in *Bacopa monnieri* are dammarane-type triterpenoidsaponins known as bacosides, The *Bacopa monnieri* primary therapeutic use is to enhance cognitive function.



**Green Tea leaf**



**Brahmi leaf**

**Fig. 1: Green tea leaf and Brahmi leaf**

## MATERIAL AND METHODS [6-10]

### Materials Used

Organic Brahmi and Green Tea were purchased from Blue Berry Agro Product Private Limited, India. The best quality of entire chemicals were used like Starch, HPMC (Anil Pharmaceuticals, Mumbai) Glacial Acetic Acid, Methanol, Ortho phosphoric and Hydrochloric Acid (LR grade, Merck), Instrument were used for characterization are Electronic balance, FTIR (Shimadzu Corporation), UV-Vis spectrophotometer (Thermo scientific, UV-10) and Dissolution tester (Bezif Company) etc.

### Methods

Preformulation studies of Green Tea (GT) and Brahmi extract powder pure drug was carried out using Drug identification test, Solubility of Green Tea and Brahmi powder was determined in distilled water, Acetonitrile, methanol, Ethanol, Acetone, 0.1 N HCl, 0.1N NaOH and Buffer solution pH 7.4 etc. Micromeretics properties of both drug extract powder were studied by determined of bulk density, Tapped Density and Angle of Repose  $\lambda_{\max}$  was determined in 0.1N HCl and scanned between the range of 200-400nm and calibration curve was prepared for both crude drugs separately. FT-IR spectra of Green Tea and Brahmi pure drug was obtained on Jasco V-530 FTIR-4100 spectrometer (Shimadzu Corporation, Japan) over the range 400- 4000 $\text{cm}^{-1}$  using dry KBr (50mg) IR grade with 4-5mg sample. Phytochemical Studies of both drug were carried out using various chemical test of phytochemical constituents.

### PREPARATION OF HERBAL CAPSULE

All Composition & Ingredients, Table 1, was weigh with starch as per their required quantity respectively. Ingredient was added one by one in starch base with gentle mixing and passed the mixture through mesh no. 44, then putted it inside Oven for 15 min at 65 $^{\circ}\text{C}$  for proper drying. After these process small size granules were reformed [11-13].

**Table 1: Composition and Ingredients used for formulation**

| Ingredients | Each Capsule<br>(500mg) Contains | For 300 Caps.<br>Batch |
|-------------|----------------------------------|------------------------|
| Green Tea   | 200 mg                           | 60 gm                  |
| Brahmi      | 50 mg                            | 15 gm                  |
| Starch      | 250 mg                           | 75 gm                  |

### Manual Filling

The ingredients were to be mixed by trituration to a fine and uniform powder, then transferred on paper and flattened with a spatula in such that the layer of the powder was not greater than about 1/3 of the length of the capsule which was being filled. The cap was removed from the selected capsules. The base was pressed repeatedly against the powder until it was filled. The cap was slipped into the base of the capsule and the whole capsules was weighed [14-17]. The spatula helps in filling the capsule by pushing the last quantity of the materials into the base. Cloth polishing was carried out using paraffin wax.

### EVALUTION OF PREPARED CAPSULE

#### Weight Variation [18-19]

The average weight of capsule along with length and diameter was determined by weighing. Randomly 20 filled capsules were selected and weighted all 20 capsules collectively, and find out average weight.

$$\text{Average weight} = \frac{\text{Wt. of 20 capsules}}{20}$$

Then weighted each 20 capsules one by one and note down their respective weights then find out percentage weight variation for each capsule with using formula-

$$\% \text{ Weight Variation} = \frac{\text{Real Wt.} - \text{Avg. Wt.}}{\text{Avg. Wt.}} \times 100$$

Maximum positive to maximum negative range was selected.

### **Disintegration Time**

The disintegration test was performed under a given set of condition for six randomly selected capsule to disintegrate into particles which will pass through a 10 mesh screen with in the apparatus using 6.8 pH (simulated saliva fluid) and assembly at maintained temperature  $37^{\circ}\text{C}\pm 0.5^{\circ}\text{C}$  as disintegration media.

### **Drug Content of Green Tea and Brahmi Extract powder**

Drug content was determined by measuring absorbance of prepared solution of extract powder, using UV Spectroscopy and determined the value using regression line of calibration curve.

### ***In Vitro* dissolution Studies**

The dissolution test was performed for capsule using capsules basket type USP dissolution apparatus. The 900 ml of the 1.2 pH acidic buffer dissolution medium was introduced into the vessel of the apparatus at the speed of 50 rpm for two hrs. After each 15 min a 10 ml specimen was withdrawn from a zone midway between the surface of the dissolution medium and top of the rotating blade or basket, in evaporating dish. Filter and evaporate the specimen [20-21]. For each of the capsule tested, the amount of dissolved active ingredient in the solution was calculated as a percentage dissolved in 1.5 hrs.

### **Release Kinetics**

*In vitro* drug release study were fitted with various kinetic equations like zero order (cumulative percent drug released vs. Time), first order (Log cumulative percent drug retained vs. Time), Higuchi (cumulative percent released vs.  $\sqrt{T}$ ), Peppas (log of cumulative percent drug released vs. log Time). The kinetic model that best fits the dissolution data was evaluated by comparing the regression coefficient (r) values obtained in various models. Peppas model used 'n' value to characterize different release mechanisms [22-23]. The values of  $n = 0.5$  for Fickian diffusion, between 0.5 to 1.0 for non-Fickian diffusion and  $n = 1$  for zero order.

### Stability Study

The formulation was stored at accelerated ( $40\pm 2^{\circ}\text{C}/ 75\% \pm 5\% \text{RH}$ ) condition wrapped in aluminum foil and kept in humidity chamber. The stability study was conducted after 30, 60, 90 days. Similarly formulation study at 30, 40, 50  $^{\circ}\text{C}$  as per WHO Guideline. At the end of three month capsules were tested for physical appearance. Disintegration Time, Drug Content, Drug Release and self-life of drug was calculated [24-27].

### RESULTS AND DISCUSSION

Result of Preformulation study organoleptic studies is reported in Table 2. Results of solubility reported in Table 3.  $\lambda_{\text{max}}$  for Green Tea and Brahmi were found to be 270nm and 278nm in 0.1M HCl respectively and calibration curve was prepared, Fig. 2. FTIR spectra of Green Tea and Brahmi powder are reported in Fig. 3. Rheological Properties of Green Tea and Brahmi extract powder indicate good flow properties, Table 4. Phytochemical Studies of both powdered drug are reported in Table 5.

**Table 2: Organoleptic Properties of Green Tea and Brahmi Extract powder**

| S. No | GT Powder  |                | Brahmi powder |             |
|-------|------------|----------------|---------------|-------------|
|       | Parameter  | Nature         | Parameter     | Nature      |
| 1.    | Color      | Brown          | Color         | Light Brown |
| 2.    | Odour      | Characteristic | Odour         | specific    |
| 3.    | Taste      | Bitter         | Taste         | Bitter      |
| 4.    | Appearance | Powder         | Appearance    | Powder      |

**Table 3: Solubility of GT and Brahmi extract powder**

| S. No. | Green Tea powder |                | Brahmi powder |                  |
|--------|------------------|----------------|---------------|------------------|
|        | Solution         | Inference      | Solution      | Inference        |
| 1.     | Distilled water  | Soluble        | Water         | Soluble          |
| 2.     | 0.1 N HCL        | Soluble        | Ethanol       | Freely Soluble   |
| 3.     | 0.1 N NaOH       | Poorly soluble | 0.1N NaOH     | Poorly soluble   |
| 4.     | Methanol         | Freely soluble | Methanol      | Slightly Soluble |
| 5.     | Acetonitrile     | Freely soluble | 0.1N HCl      | Soluble          |

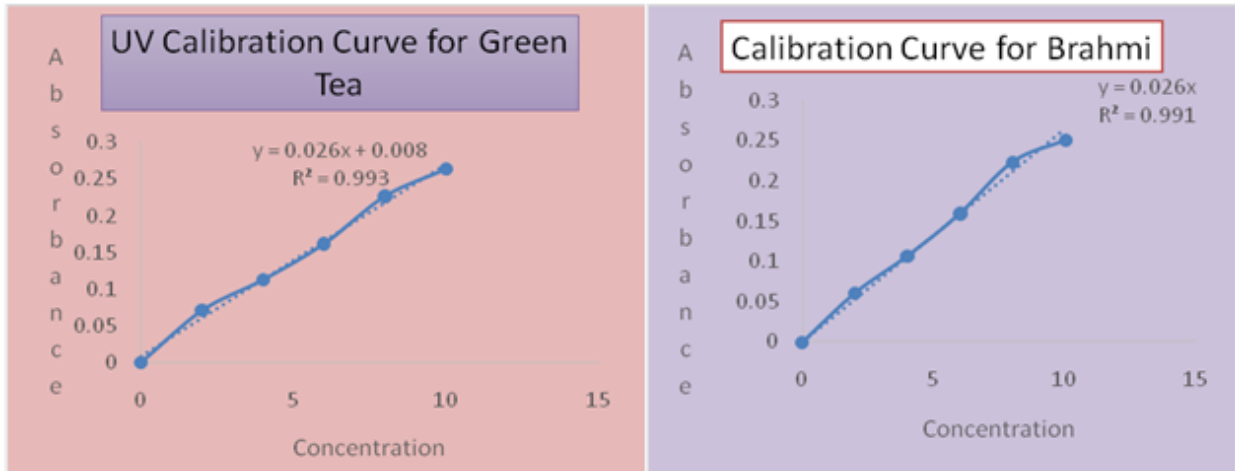
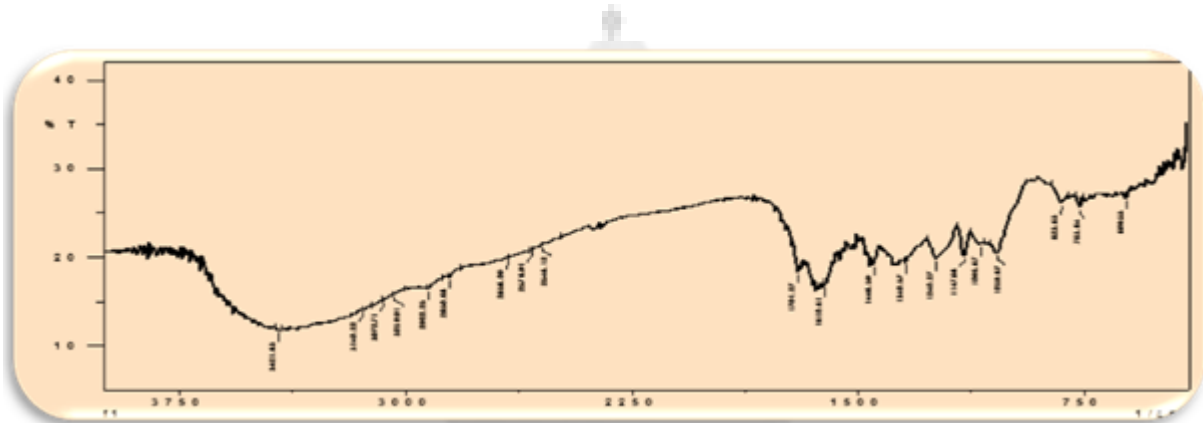
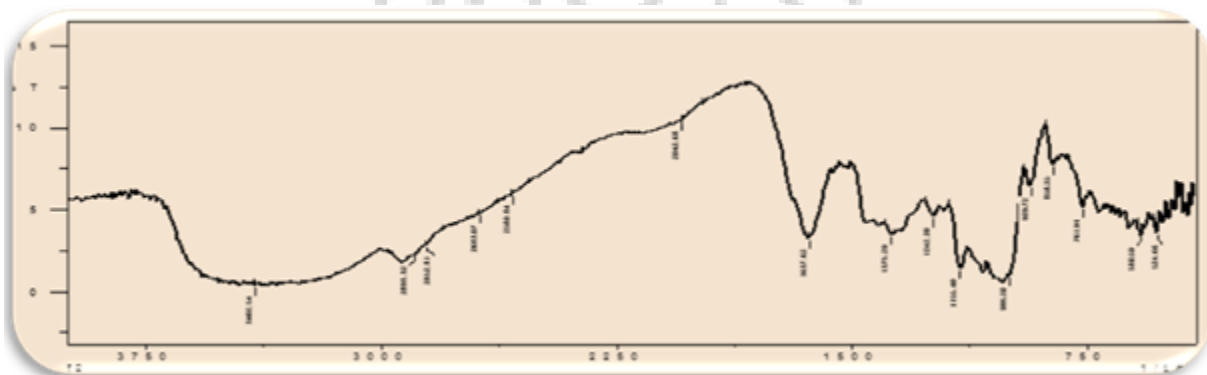


Fig. 2: Calibration curve of green tea and Brahmi in 0.1M HCl



FTIR spectra of Green Tea powder



FTIR spectra of Brahmi powder

Fig. 3: FTIR spectra of Green Tea and Brahmi powder

**Table 4: Rheological Properties of GT and Brahmi extract powder**

| S. No | Parameters     | GT powder          | Brahmi powder      |
|-------|----------------|--------------------|--------------------|
|       |                | <b>Observation</b> | <b>Observation</b> |
| 1.    | Angle Repose   | 30°±0.40           | 30°±0.02           |
| 2.    | Bulk Density   | 0.24±0.48          | 0.24±0.27          |
| 3.    | Tapped Density | 0.27±0.56          | 0.27±0.31          |
| 4.    | Carr's Index   | 16±0.02            | 16±0.02            |
| 5.    | Hauser Ratio   | 1.26±0.52          | 1.26±0.04          |

**Table 5: Results of Phytochemical Studies**

| S. No | GT powder         |                     | Brahmi powder     |                        |
|-------|-------------------|---------------------|-------------------|------------------------|
|       | <b>Test</b>       | <b>Result</b>       | <b>Test</b>       | <b>Result</b>          |
| 1.    | Glycoside         | Reddish Brown Color | Tannin            | Blue Black Color       |
| 2.    | Terpenoid         | Red Violet colour   | Saponin           | Stable                 |
| 3.    | Steroid           | Green Bluish color  | Terpenoid         | Reddish Brown color    |
| 4.    | Flavonoid         | White colour        | Cardiac Glycoside | Violet colour          |
| 5.    | Gallic Tannin     | Blue color          | Anthraquini none  | Layer obtain White ppt |
| 6.    | Catecholic Tannin | Green Black color   | Flavonoids        | Yellow color           |
| 7.    | Saponin           | Brown color         | Steroids          | Red color              |



### Results of Evaluated Capsule

The weight variation was found in the range of -4.40% to +4.89%, Table 6. The disintegration time of all 6 capsule was from 3 min 23 sec. to 6 min. 45 sec. and the average disintegration time of the capsule is 4 min. In vitro drug release and %release of drug from prepared capsule was found in the range of 90 to 99%, results are reported in Table 7&8 and Fig. 4 & 5.

The Drug content of capsule of range in the green tea extract  $197.5 \pm 1.48$  mg and Brahmi extract  $48.3548.35 \pm 0.98$  mg. Stability Study All the above evaluation parameters are again study in 30, 60 and 90 days, means in the interval of 30 day a month and the result found that all the parameters were in the standard range, Table 9, it means drug are stable.

**Table 6: Weight Variation of capsule**

| No. | Weight (In mg) | % Wt. Variation | No. | Weight (In mg) | % Wt. Variation |
|-----|----------------|-----------------|-----|----------------|-----------------|
| 1   | 631            | +2.93%          | 11  | 634            | + 3.42%         |
| 2   | 616            | + 0.48%         | 12  | 593            | -3.26%          |
| 3   | 623            | +1.63%          | 13  | 595            | -2.93%          |
| 4   | 607            | - 0.97%         | 14  | 631            | +2.93%          |
| 5   | 643            | + 4.89%         | 15  | 604            | -1.46%          |
| 6   | 604            | - 1.46%         | 16  | 612            | -0.16%          |
| 7   | 599            | -2.28%          | 17  | 603            | -1.63%          |
| 8   | 586            | -4.40%          | 18  | 615            | + 0.32%         |
| 9   | 614            | 0.16%           | 19  | 629            | +2.61%          |
| 10  | 624            | + 1.79%         | 20  | 625            | +1.95%          |

Table 7: % Cumulative drug release of Green tea extract

| Time<br>(Min) | Cumulative % Release |           |           |           |           |           |
|---------------|----------------------|-----------|-----------|-----------|-----------|-----------|
|               | Capsule 1            | Capsule 2 | Capsule 3 | Capsule 4 | Capsule 5 | Capsule 6 |
| 0             | 00                   | 00        | 00        | 00        | 00        | 00        |
| 15            | 8.5                  | 12        | 7         | 10.5      | 15.5      | 7         |
| 30            | 21                   | 24        | 26        | 24        | 27.5      | 31.5      |
| 45            | 48                   | 48.5      | 49.5      | 41.5      | 45        | 46.5      |
| 60            | 58.5                 | 64        | 64        | 62.5      | 64        | 67.5      |
| 75            | 74.5                 | 81        | 83        | 83        | 76.5      | 79.5      |
| 90            | 93                   | 97        | 97        | 99        | 93        | 90        |

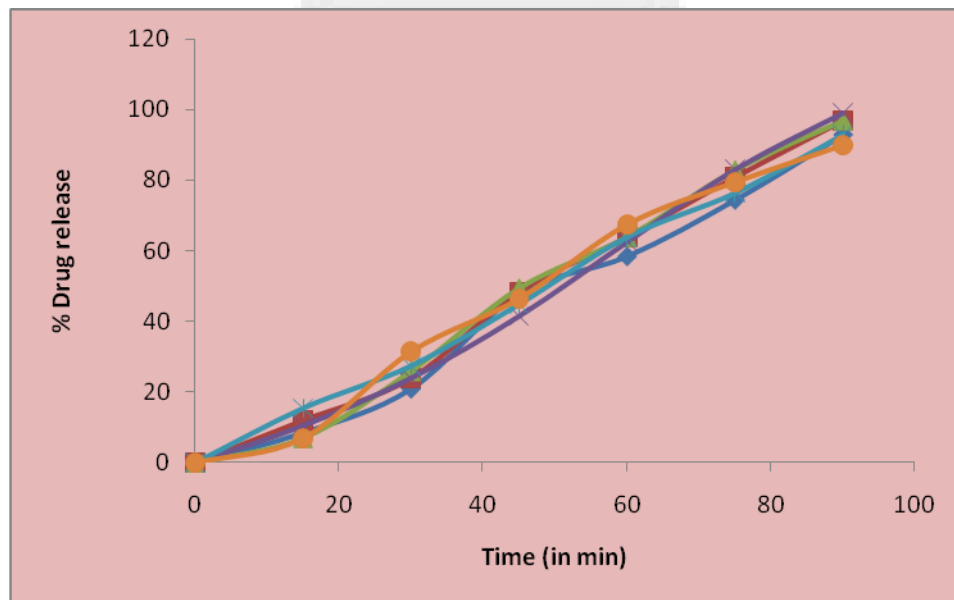
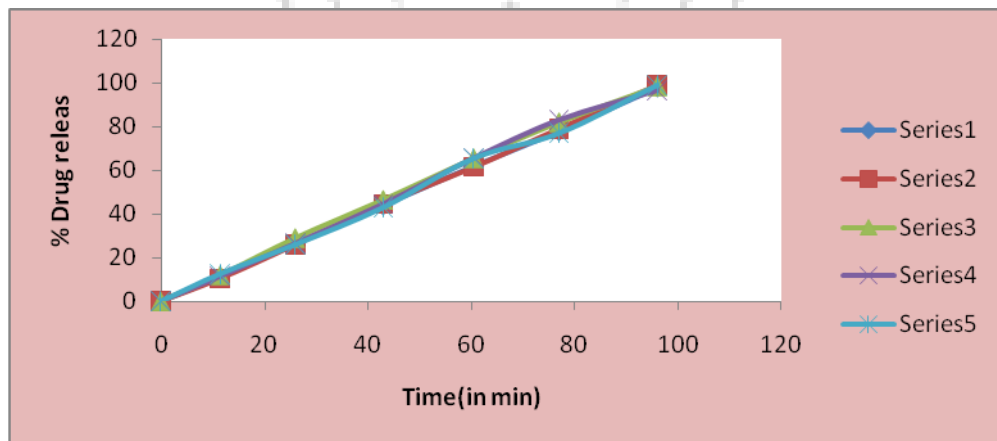


Fig 4: Graph of *In Vitro* dissolution Studies

**Table 8: % Cumulative drug release of Brahmi extract**

| Time (in min) | Capsule 1 | Capsule 2 | Capsule 3 | Capsule 4 | Capsule 5 | Capsule 6 |
|---------------|-----------|-----------|-----------|-----------|-----------|-----------|
| 0             | 00        | 00        | 00        | 00        | 00        | 00        |
| 15            | 11.5      | 11        | 10.5      | 12        | 11.5      | 12.6      |
| 30            | 26.00     | 26.5      | 26        | 29        | 26.5      | 26.00     |
| 45            | 43.00     | 44        | 44.5      | 46.5      | 44.5      | 43.00     |
| 60            | 60.50     | 62        | 61.5      | 65.5      | 65.5      | 65.5      |
| 75            | 77.00     | 78        | 79        | 82        | 83        | 77.00     |
| 90            | 96.00     | 98        | 99        | 98.5      | 96.5      | 99        |



**Fig 5: In Vitro Drug Release Profile**

**Table 9: Stability Study of capsule**

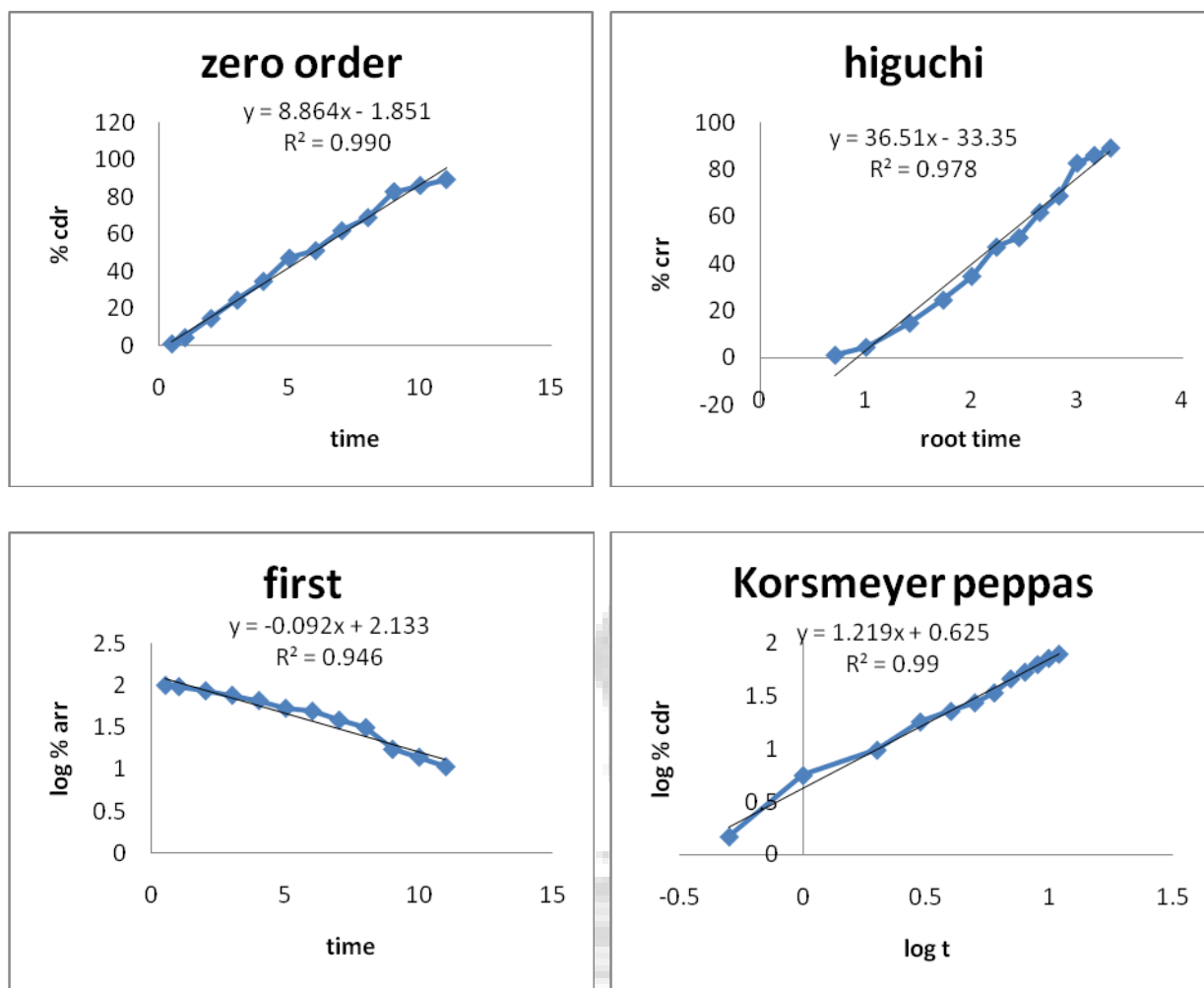
| S. No. | Parameter                  | Day 0               | Day 30              | Day 60              | Day 90              |
|--------|----------------------------|---------------------|---------------------|---------------------|---------------------|
| 1      | %Weight Variation<br>Range | -3.76% to<br>+4.72% | -3.95% to<br>+4.96% | -3.54% to<br>+5.12% | -4.26% to<br>+5.66% |
| 2      | Disintegration Time        | 3 min. 10<br>sec.   | 4 min. 45<br>sec.   | 5 min. 16<br>sec.   | 6 min. 43<br>sec.   |
| 3      | Drug Content               | 198 mg              | 194 mg              | 186mg               | 184mg               |
| 4      | % Drug Release             | 99                  | 97.6                | 94.2                | 92                  |

**Drug Release Kinetics Data Analysis**

Kinetics and mechanism of drug release from all Capsule was evaluated on the basis of Zero Order, First Order, Higuchi equation and Peppas model, Fig. 6. The  $r^2$  values for each batch are reported in Table 10.

**Table 10: Kinetics and mechanism of drug release**

| Capsule   | Zero  | Higuchi | First | Korsmayer | Best Fit Model |
|-----------|-------|---------|-------|-----------|----------------|
| Capsule 1 | 0.973 | 0.991   | 0.992 | 0.995     | Korsmayer      |
| Capsule 2 | 0.974 | 0.991   | 0.991 | 0.995     | Korsmayer      |
| Capsule 3 | 0.973 | 0.975   | 0.910 | 0.991     | Korsmayer      |
| Capsule 4 | 0.952 | 0.984   | 0.831 | 0.985     | Korsmayer      |
| Capsule 5 | 0.941 | 0.984   | 0.989 | 0.985     | First          |
| Capsule 6 | 0.987 | 0.959   | 0.962 | 0.974     | Zero           |



**Fig. 6: Model Fitting For Capsule 4**

## CONCLUSION

The drug content label claim of all prepared capsule is 200mg of green tea and 50mg of Brahmi, after its assay the result is found that green tea is 198.56mg & Brahmi extract is 49.05mg, which are in range. Dissolution Study drugs complete release time is 90 min. and found to maximum drug release 99%. Stability Study indicate drugs are stable. On the basis of Evaluation and pre formulation studied both drugs was found compatible with each other and they pass all test at various conditions So, this is a best Nutraceutical diet and supplements for the women's and children's, Where green tea give a lot of health benefits meanwhile Brahmi strengthen the memory enhancement and brain capacity, and avoids a lots of nervous system problems.

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