SEED POWDER OF *STRYCHNOS POTATORUM* AS A NEW NATURAL EMULSIFYING AGENT

ABSTRACT

Stable emulsions represent an effective formulation approach for masking the bitter taste of many drugs. Due to some unwanted side effects observed recently, synthetic surfactants are facing disfavor during the formulation of emulsions. The present study was undertaken to assess the potential of the traditional medicinal plant *Strychnos potatorum* seed powder as a new natural emulsifying agent. Physicochemical properties of the seed powder, acacia and tragacanth were compared. Castor oil emulsions were prepared by wet-gum method, using seed powder and gum acacia at different concentrations. The physical stability of the prepared emulsions was evaluated by freeze-thaw cycling and centrifugation methods. The results were graphically represented and summarized. In the centrifugation, the lowest volumes of aqueous phase were separated for F1 and F7 emulsions. The results showed that the seed powder of *S. potatorum* could be utilized as a promising alternative natural emulsifying agent.

Keywords: Oral emulsions, *Strychnos potatorum*, freeze-thaw cycling, globule size analysis

INTRODUCTION

An emulsion is a thermodynamically unstable system stabilized by the presence of an emulsifying agent. It is a convenient dosage form to mask the objectionable taste and improvement of bioavailability often related to poorly soluble drugs. There are two groups of emulsifying agents, namely naturally occurring polysaccharides and synthetic surface active agents. Although synthetic surfactants form highly stable emulsions, some recent studies have found that they cause various side effects like peripheral neurotoxicity and membrane damaging effects leading to hemolysis and tissue irritation[1]. Hence, natural emulsifying agents resumed more interest in the preparation of kinetically stable pharmaceutical and food emulsions. Market demand for safe and effective natural products has also created a need to search for suitable alternatives[2]. Many plant gums have been studied as emulsifying agents[3], suspending agents[4] and tablet binders[5]. Gum from *Moringa oleifera* was found to be a secondary emulsifying agent in the formulation of castor oil emulsions[6]. The seed powder of *Strychnos potatorum* was widely used in traditional medicine. The acute and chronic toxicity studies of seed powder of *S. potatorum* confirmed the non-toxic nature of the seed powder[7]. The present work was aimed at evaluating the potential of the seed powder of the medicinal plant *S. potatorum* as a new emulsifying agent.

MATERIALS AND METHODS

Gum acacia was procured from Oxford Laboratories Private Limited, India. Tragacanth was procured from Otto Chemie Private Limited, India and sodium benzoate was procured from Fischer Scientific Chemicals, India. Castor oil and *S. potatorum* seeds were obtained from the local market. All other solvents and reagents were of analytical grade. The seeds were dried in an oven at 40° C for 24 h and crushed into a powder using mixer grinder. The coarse powder was passed through sieve number 80, and the collected fine powder was stored in a desiccator for further use.

The flow properties of the seed powder prepared in the present work, acacia and tragacanth powders procured commercially, were compared by angle of repose, bulk density, tapped density, Carr's index and Hausner's ratio measurements[8]. The mucilages of the three emulsifying agents at 5% w/V in purified water were prepared and evaluated. The pH of the mucilages was noted using an Elico pH meter at room temperature. The viscosity and surface tension of the mucilages were measured using Brookfield DV-E viscometer and stalagmometer respectively. Swelling index was measured by taking 1 g of each material in a 25 mL measuring cylinder and measuring the initial and final volumes of the hydrated material in distilled water[9]. Tragacanth was included in the evaluation of physical properties for comparison purposes only.

A total of 9 o/w castor oil emulsions of strength 45% w/V were prepared by wet gum method in the present work. Acacia was used at concentrations of 10% (F1), 12% (F2), 16%w/V (F3) and *S. potatorum* seed powder

Table I: Comparison of physical properties of different mucilages

Type of mucilage	Specific gravity	Swelling index (%)	pH	Surface tension (Newton/meter)	Viscosity (Pascal-second)
Gum acacia	1.21	18	6.15	0.063	0.018
Tragacanth	1.18	29	6.05	0.067	0.027
Seed powder	1.12	37	6.17	0.061	0.036

at concentrations of 3% (F4), 5% (F5), 8% (F6), 10% (F7), 12% (F8) and 16%w/V (F9) as emulsifying agents. Sodium benzoate (0.5%) was used as a preservative. The prepared emulsions were transferred into glass bottles and subjected to accelerated stability testing by freeze-thaw cycling[10]. The emulsions were alternately stored initially in a refrigerator for 12 h at 10° C and then in a thermostatically controlled hot air oven for 12 h at 40°C for 10 days. The emulsions were allowed to attain room temperature during the changeover. In the centrifugation study, 10 mL of all the emulsion samples were taken into centrifuge tubes and rotated using a laboratory centrifuge (Remi Electrotechnik Ltd.) for 10 minutes at 2000 rpm. The volume of aqueous liquid phase separated at the bottom of the tubes was noted[11]. Globule size analysis was performed using a Lawrence and Mayo optical microscope at 100X magnification. The emulsion was diluted, smeared on a slide, mounted on the mechanical stage and focused properly. 100 globules were measured in each case and the average globule size versus frequency was calculated and plotted as a graph. The eye piece micrometer of the microscope was calibrated initially using Ermo stage micrometer. Globule size analysis was performed before and after freeze thaw cycling (FTC).

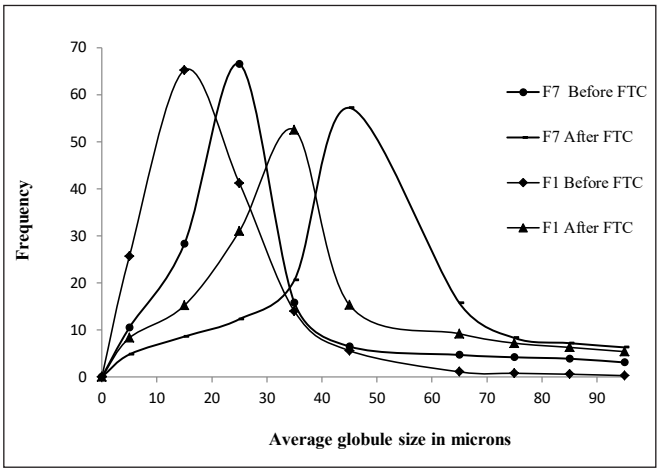

Fig. 1: Globule size analysis of 10% seed powder (F7) and 10% acacia (F1) emulsions

RESULTS AND DISCUSSION

A fine and characteristic flavored powder with light brown color was obtained after milling of the seeds of *S. potatorum.* The bulk density of the seed powder was slightly lower when compared to acacia. Carr's index, Hausner's ratio and angle of repose values obtained have indicated good flow properties, according to USP guidelines. Physical properties of the mucilages were reported in Table I. Viscosity and swelling index of seed powder were found to be higher when compared to acacia and tragacanth. The pH values were similar for all the mucilages and the obtained values were present in the neutral region. Compared to purified water, a small decrease in the surface tension was observed with all the mucilages.

All the prepared emulsions were found to be stable during and after FTC without showing any signs of cracking. Seed powder incorporated into the emulsions didn't show any precipitation or degradation reaction during the evaluation period. From the results of the centrifugation study, aqueous liquid phase separation was observed at the bottom of the centrifuge tubes but the volume of it was different in different emulsions. The lowest volumes of aqueous phase separated were 1.8 mL and 1.3 mL respectively, for F1 and F7 emulsions. The volumes of aqueous phase separated were in the range of 2.6-1.7 mL for the remaining emulsions. Based on centrifugation study results, 10% acacia (F1) and 10% seed powder (F7) emulsions showing optimum stability due to lowest aqueous phase separation were selected for globule size analysis. Globule size analysis for selected emulsions (F1 and F7) before and after FTC was performed and the results are shown in Fig. 1. The majority of the globules were present in the acceptable size range of 10-30 microns in the selected emulsions. After FTC, there was a remarkable decrease in the frequency of the fine globules (10-30 microns), with a simultaneous increase in the occurrence of larger globules (30-60 microns), as indicated in Fig. 1. The phenomenon of aggregation was clearly reflected in the globule size

distribution in the emulsions after stability studies. FTC has significantly induced enlargement and aggregation of oil globules[12]. Based on centrifugation and microscopic studies, F7 was found to be the best formulation in the present work. Phytochemical studies of the seeds of *S. potatorum* have revealed the presence of alkaloids, glycosides, phenols, saponins, sterols and tannins[13]. According to previous pharmacological reports, crude extracts of seed powder of *S. potatorum* have shown many medicinal applications, when given to animals at 100 mg kg^{-1}- 200 mg kg^{-1} doses[14]. The concentration of 10% seed powder employed in the present study represents an animal dose which is very much lower than the administered dose in pharmacological investigations. Hence the proportion of seed powder is justifiable for its use as oral excipient in the present study.

CONCLUSION

The physico-chemical properties of the seed powder were found to be comparable to those of acacia and tragacanth commercial powders in the present study. The physical stability of the castor oil emulsions prepared by the seed powder was very closely comparable to the emulsions prepared using gum acacia. In the present study, it was concluded that seed powder of the medicinal plant *S. potatorum* could be utilized as an effective emulsifying agent at a lower concentration range compared to that of gum acacia. Oral emulsion, formulation F7, containing seed powder at 10%, was found to exhibit acceptable physical stability in the present investigation. There is no evidence of research on the seed powder of *S. potatorum* as a pharmaceutical excipient. This information can be used as basis for further research.

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