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MICROENCAPSULATION OF *LACTOBACILLUS CASIE* AND *LACTOBACILLUS PLANTARUM* BY USING ACID MODIFIED *PSYLLIUM* HUSK

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Abstract– *Psyllium* husk is soluble in water and excellent source of prebiotic. *Psyllium* has the ability to promote probiotic development in the colon and bacterial proliferation in the digestive system. The primary objective of this study was to add modified *psyllium* husk to alginate beads that contained probiotic bacteria, namely *Lactobacillus casie* and *Lactobacillus plantarum*. The modified *psyllium* husk exhibited a dietary fiber content excellent dietary fiber and demonstrated better functional characteristics. These findings were put to use in further encapsulation research.

INTRODUCTION

Plantago ovata belongs to the family Plantaginaceae, which frequently gets referred to as *psyllium*. Because it resembles a horse's ear, the plantago seeds are major commercial operations crop farmed in Iran, Pakistan, and India got its name, isabgol (Verma *et al.,* 2013 and Haddadian *et al.,* 2014). *Plantago* (family Plantaginaceae) is the scientific name for *psyllium*, an invasive species native to tropical regions. *Psyllium* refers to more than 200 species in the *plantago* genus. It is also known as isabgol and ispaghula in common Indian language. An indigenous plant of persia, *psyllium* gets its name "isabgol" from the persian word "band ghoul," which translates to "horse flower" and characterizes the form of the *psyllium* seed (Ricklefs-Johnson *et al.,* 2017). *Psyllium* husk, or seed coat, is another significant ingredient in the food industry and is used in ice cream, candy, and bakeries. *Psyllium* is easily obtainable (Yu L *et al.,* 2017). Probiotic literally means "for life," and its name comes from two Greek terms(Vivek K. B 2013). Immunologist Dr. Eli Metchnikoff (Nobel Prize, 1908) was the first scientist to identify the health advantages of probiotics (Daniela Paraschiv, 2011). Probiotics are often live bacteria added to nourishment to improve the gut microbial balance in humans and offer health benefits (Qurat ul ain riaz, 2013). Probiotics are defined as "live microorganisms that when administered in adequate amounts confer a health benefit on the host" by the Food and Agriculture Organization (FAO) of the United Nations and the World Health Organization (WHO) [FAO/WHO (2001)].

MATERIALS AND METHODOLOGY

Material

Raw materials

The basic components, including *psyllium* husk, were purchased at the Parbhani local market.

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Methods

Preparation of starter culture

The probiotics *Lactobacillus casie* and *Lactobacillus plantarum* were cultured separately in MRS broth for 48 hours at 37 °C. To extract the cells, the grown MRS broth was centrifuged for 10 minutes at 4,000 RPM. Two separate cycles of washings with 1% peptone water were performed on the collected cells.

Acid modification of *psyllium* husk

According to Xiaoyin Pei (2008) instructions, *psyllium* husk was acid modified by varying the amount of HCL in the ethanol solvent. For the purpose of treating the *psyllium* husks acid, ethanol was dissolved in 34%–37% hydrochloric acid (HCl) at different concentrations of 0.65% (w/v).The purpose of the study was to determine how the physico-chemical and functional characteristics of the acid-modified *psyllium* samples were affected by the concentration of acid and the ratio of *psyllium* to solvent. Three distinct *psyllium*-solvent ratios (PSH: Solvent @ 1:6 (w/v), g/ml) were investigated at a reaction temperature of 37.5 °C. Therefore, 48 g of *psyllium* husk was split into 4 groups, each containing 16 g of PSH, for treatments varying in the amount of 0.65% (w/v) hydrochloric acid in ethanol solvent. As previously indicated, *psyllium* to solvent ratios were applied to four samples in each group. The samples were incubated for 48 hours at 37.5 °C after the solvent was added. Samples were then vacuum-filtered, washed twice with 95% and 100% ethanol, dried, and stored. The control group underwent the above-mentioned preparatory stages and received 100% ethanol treatment.

Microencapsulation of strains

The extrusion process was used to microencapsulate probiotic microorganisms. This procedure involved combining sodium alginate at 1 and 0.8% (w/v), respectively, to create a hydrocolloid solution.2 grams of modified *psyllium* husk were combined with 10 milliliters of inoculum (5 milliliters of each of *L. casie* and *L. plantarum*). After carefully combining modified *psyllium* husk powder and probiotic culture, droplets were introduced into a 0.3 M calcium chloride solution using a syringe. Beads (3-5 mm) were formed by the interaction of the two solutions, and these beads were then preserved in 0.1% peptone (Karthikeyan *et al.,* 2014).

RESULT AND DISCUSSION

Encapsulation Efficiency (EE)

The encapsulation efficiency was determined by first mechanically disintegrating the prepared beads in phosphate buffer (pH = 6.8), followed by a pour plate method measurement of the number of entrapped cells adhering to an appropriate dilution. The counts were expressed as the number of colonies forming units (CFU) and computed as

$$EE\ \% = \frac{(\log 10N)}{(\log 10N0)} \times 100$$

where N0 is the number of free cells injected to the biopolymer mixture just before to the manufacturing process, and N is the number of live entrapped cells released from the beads.

Table 1. Encapsulation Efficiency

Encapsulation efficiency
97
98.5
99.3

Encapsulation efficiency of probiotic beads was found 97 per cent, 98.5 per cent, 99.3 percent, respectively.

Table 2. Effect of modification on proximate composition of acid modified *psyllium husk*

Parameter	Native *psyllium* husk	Modified *Psyllium* husk
Moisture (%)	7.18	7.38
Fat (%)	1.86	0.66
Protein (%)	2.64	1.33
Ash (%)	2.54	2.26
Carbohydrate (%)	82.05	85.89
Crude fiber (%)	3.9	2.68

Following table acid modification, the moisture level of *psyllium* husk increased from 7.18 to 7.38 percent, according to Table 2 data for the proximate composition of the material. After acid alteration, the percentage of fat decreased from 1.86 to 0.66 percent, while the percentage of protein decreased from 2.64 to 1.33 percent. Concurrently, the percentages of ash and crude fiber dropped from 2.54 to 2.26 percent and 3.9 to 2.68 percent, respectively. The partial breakdown of the *psyllium* gel hardness brought about by the acid alteration of

the *psyllium* husk led to reductions in the quantity of fat, protein, ash, and crude fiber. Additionally, the percentage of carbohydrates rose from 82.05 to 85.89 respectively.

CONCLUSION

The plantago ovata forsk seed is a rich source of dietary fiber that is known to include *psyllium*. The current study examines the effects of acid modification using ethanol as a solvent and a concentration of 0.65% of 37% hydrochloric acid (HCL). The impact of acid treatment on the solvent ratio of *psyllium* husk, which enhances its functional qualities without changing the dietary fiber content. Without sacrificing its nutritional qualities, modified *psy*

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