CHAPTER 6

Conclusion

6.1 Conclusion

The pea which is virtually grown worldwide for its edible seeds is nutritionally very rich and in addition it is ladened with high dietary fiber, antioxidants, numerous important biomolecules and having low glycemic index and is extremely useful in curing diabetes, cardio problems, certain cancers and many degenerative diseases. Overall, provides the nutritional information of peas and its underexploited by-products particularly its peel and focussing primarily on their impact on health and various functional properties. The desirable functionality of pea and its waste make them potentially suitable for food industry.

The present study explicated that alkaline extraction (ADF), ultrasound assisted extraction (UDF) and ultrasound assisted alkaline extraction (ODF) methods on GPP dietary fiber evinced changes in the yield, kinetics, thermal stability, morphology, and the functional properties of IDF. The yield of the IDF was much higher in UDF and ODF compared to ADF. The thermal degradation was lowest for ODF, in terms of mass loss over the other extraction processes. The ODF showed lowest thermal stability in terms of peak temperature (118.4°C) and conclusion temperature (149.0°C). Moreover, the morphology of ODF showed typical honeycomb structure, which made larger pores in the cell wall and loosed the fibrous structure and enhanced the functionality. The ODF was found to be the best extraction method with rich biological potential and higher yield. Characterization of IDF of GPP revealed that this fiber might be considered as the potential element which could be used as one of the functional ingredients in dairy, meat industries, beverages such as snacks, pasta and ready to eat cereals to provide stability, emulsion strength and water holding capacity. This potential application could create substantial economic benefits by utilizing this GPP by-product and thereby lessen the environmental footprint.

Extrusion and enzymatic treatments were reasonably effective methods for modifying the insoluble dietary fiber (IDF) in pea peels. Extrusion with various process conditions and a combination of cellulase and xylanase significantly improved the physicochemical and functional properties by destroying the crystalline region and enzymes tend to attack the amorphous portion. The IDF's microstructure was destroyed more rigorously which created more oligosaccharides due to specificity of enzymes. The crystallinity improved due to the disruption in the molecular structure. In comparison to the unmodified IDF, the BET surface area was much higher and WRC, SC, OAC, and CEC of the modified IDF improved significantly ($p < 0.05$). The oscillatory rheological behaviour of the yogurt changed significantly when the modified IDF was added. Extrusion and enzyme treatments might be used to customise the IDF and can be used it as a functional food element in dairy and other foods. Pea peel enzymatically modified insoluble dietary fiber (MDF) might be used as prebiotic as it showed a significant positive prebiotic index and relative growth value. The two different prebiotic ingredients used as a growth medium for *L. rhamnosus* ATCC 7469, where DF presented a positive influence over the growth of microbial biomass. With 30 h of fermentation process, it was possible to observe that the prebiotic ingredients that is pea peel DF foster cellular growth of *L. rhamnosus.* Furthermore, under the *in vitro* gastrointestinal digestion model, a significant change was detected in the dietary fiber and glucose fractions in the presence of probiotic *L. rhamnosus.* However, when dietary fiber was subjected to gastro-intestinal phases was more resistant to the enzymes present in the SIF and SGF. These results highlight the possibility of pea peel dietary fiber to reach the large intestine, target organ, to exert their potential prebiotic effects.

Finally, lactose free set type yogurt was developed with enzymatically modified and unmodified pea peel dietary fiber. Modified fiber helped in reducing the syneresis as well as improving the textural properties of the yogurt, although fiber addition was found to interfere with the protein network and their interaction during storage. The sensory quality of lactose free yogurt fiber gave slightly yellowish color to the entire sample and up to 1.5% modified fiber concentration was found to be the best sample in overall attributes. Therefore, it can be concluded that lactose free yogurt with fiber can be successfully utilized and gave huge scope for lactose intolerant people with improving gut problem by modulating the intestinal bacteria by incorporating prebiotic and probiotic supplements.

6.2 Future prospects of the present study

- A detailed *in vitro* and *in vivo* gastrointestinal study and other health-beneficial properties of pea peel insoluble and soluble dietary fiber can be carried out.
- Microbial modification can also be an alternative modification process for obtaining fiber with similar or better functional properties.
- Phytochemicals extraction and its effects associated with modified dietary fiber can be carried out by assessing *in vitro* antioxidant activity of simulated gastric and intestinal fluids.
- *In vivo* antidiabetic study should be conducted to support the hypoglycaemic effects of extracted DF and also *in vivo* study of glycemic index is required to access the anti diabatic property of the modified dietary fiber.
- Further investigation is required to access the conformational changes between yogurt proteins and polysaccharides addition of DF.

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