Extraction and microencapsulation of anthocyanin-rich extract from pigmented rice bran using double emulsion complex coacervation and its application in food model

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Chapter 7

Summary, conclusions and future scope

7.1. Summary and conclusions

The chapter summarizes the conclusion and summary of the present research study. The present investigation summarized the value addition of the pigmented rice bran in the form of functional food product. The study involved the evaluation of different properties of pigmented and non-pigmented rice of Manipur and compared with other published literature. The research work concluded that the colored rice varieties has enhanced and numerous medicinal and nutritional properties over white rice. Significant differences were also observed among the different rice varieties for both physicochemical and thermal properties. During the investigation, anthocyanin was found highest in the black rice variety. Further studies involved the extraction of the bioactive compounds from the black rice bran using novel extraction technique i.e., Ultrasound-assisted extraction (UAE). The solvent extraction using UAE of black rice bran is a green process for the preparation of natural antioxidants, a potential source which can replace synthetic antioxidants. The UAE of total phenolic content, flavonoids, anthocyanin and the antioxidant activity of black rice bran was optimized and accessed. The optimized extract obtained based on the highest anthocyanin content was further concentrated and used for microencapsulation. The microencapsulation process carried out by double emulsion preceding complex coacervation using gelatin and acacia gum as the wall materials resulted good encapsulation efficiency which means the encapsulation process was effective. The stability of both the emulsions (primary and double emulsion) developed by different formulations of the wall materials and the core solution (anthocyanin-rich extract) during the encapsulation process were visually observed. Physico-chemical properties such as moisture content, solubility, hygroscopicity and encapsulation efficiency studies resulted the double emulsion framework of anthocyanin-rich bioactive compounds were successfully incorporated. Gradual, slow and controlled release of the targeted material could be achieved from the result of the solubility study. Moreover, the stability of the anthocyanin retention of all microcapsules were observed to be reduced with longer storage condition, whereas, high stability of anthocyanin retention in microcapsules was observed in the refrigerated storage condition. Lastly, the best microcapsule obtained based on the highest anthocyanin retention was incorporated in a jelly matrix to produce a functional food. The microcapsules act as functional ingredient in the jelly matrix which was

developed using coconut water. The functional food thus developed could be a stable source of potential nutraceuticals which also fulfils the demand of healthy foods promoting health characteristics by consumers in recent years. The research study concluded that value addition of black rice bran encapsulates as a functional component was successfully carried out for the development of value-added food product.

7.2. Future Scope

Promotion of the black rice bran in terms of functional foods was successfully performed in this research objective. Among the bioactive compounds, anthocyanins from pigmented rice are known to content a prominent functional component which are responsible for many biological activities and provides therapeutic benefits. In recent years, progress has been achieved tremendously in extraction of bioactive compounds and biological activities of active components present in pigmented rice. Additionally, attention should be addressed to minor components in pigmented rice as special effects of pharmacodynamic could be found from them. Special pharmacodynamic effects such as antiobesity, antiinfluenza and antidiabetic activities need to be explored and studied more effectively. The noticeable biological activities and the structural diversities of the compounds present in pigmented rice recommend that further studies should be performed on colored rice varieties which is worthy and may lead to new functional constituent identification. In brief, pigmented rice and its by-products provide great potential in the field of food and pharmaceutical application and extraction and encapsulation could be of wonderful technique for these applications as functional ingredients. More research based on the pharmacodynamic effects need to be studied in the future.