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Regulation Effect of Intestinal Microbiota by Fermented Processing Wastewater of Yuba

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Abstract : As a by-product of yuba, processing wastewater of Yuba (PWY) contains many bioactive components such as soybean isoflavones, soybean polysaccharides and soybean oligosaccharides, which is a good source of prebiotics and has a potential of high value utilization. The use of Lactobacillus plantarum to ferment PWY can be considered as a potential biogenic element, which can regulate the balance of intestinal microbiota. In this study, firstly, Lactobacillus plantarum was used to ferment PWY to improve its content of active components and antioxidant activity. Then, the health effect of fermented processing wastewater of yuba (FPWY) was measured in vitro. Finally, microencapsulation technology was used applied to improve the sustained release of FPWY and reduce the loss of active components in the digestion process, as well as to improving the activity of FPWY. The main results are as follows: (1) FPWY presented a good antioxidant capacity with DPPH free radical scavenging ability (0.83 ± 0.01 mmol Trolox/L), ABTS free radical scavenging ability (7.47 ± 0.35 mmol Trolox/L) and iron ion reducing ability (1.11 ± 0.07 mmol Trolox/L). Compared with non-fermented processing wastewater of yuba (NFPWY), there was no significant difference in the content of total soybean isoflavones, but the content of glucoside soybean isoflavones decreased, and aglyconic soybean isoflavones increased significantly. After fermentation, PWY can effectively reduce the soluble monosaccharides, disaccharides and oligosaccharides, such as glucose, fructose, galactose, trehalose, stachyose, maltose, raffinose and sucrose. (2) FPWY can significantly enhance the growth of beneficial bacteria such as Bifidobacterium, Ruminococcus and Akkermansia, significantly inhibit the growth of harmful bacteria E.coli, regulate the structure of intestinal microbiota, and significantly increase the content of short-chain fatty acids such as acetic acid, propionic acid, butyric acid, isovaleric acid. Higher amount of lactic acid in the gut can be further broken down into short chain fatty acids. (3) In order to improve the stability of soybean isoflavones in FPWY during digestion, sodium alginate and chitosan were used as wall materials for embedding. The FPWY freeze-dried powder was embedded by the method of acute-coagulation bath. The results show that when the core wall ratio is 3:1, the concentration of chitosan is 1.5%, the concentration of sodium alginate is 2.0%, and the concentration of calcium is 3%, the embossing rate is 53.20%. In the simulated in vitro digestion stage, the release rate of microcapsules reached 59.36% at the end of gastric digestion and 82.90% at the end of intestinal digestion. Therefore, the core materials with good sustained-release performance of microcapsules were almost all released. The structural analysis results of FPWY microcapsules show that the microcapsules have good mechanical properties. Its hardness, springness, cohesiveness, gumminess, chewiness and resilience were 117.75± 0.21 g, 0.76±0.02, 0.54±0.01, 63.28±0.71 g·sec, 48.03±1.37 g·sec, 0.31±0.01, respectively. Compared with the unembedded FPWY, the infrared spectrum results showed that the microcapsules had embedded effect on the FPWY freeze-dried powder.

Keywords : processing wastewater of yuba, lactobacillus plantarum, intestinal microbiota, microcapsule
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