

Production of resistant starch used in Microencapsulation of probiotic bacteria

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Summary

The chemical composition was estimated for potatoes, sorghum and rice, and was noticed the difference in the chemical composition significantly for this sources. Increasing of moisture as compared with potatoes and rice which reached 76.3% , and sorghum significantly with high proportion of protein, fat and ash (13.80, 2.5 and 1.70)% respectively. The highest proportion of carbohydrate was found in rice as it reached 80.43% .

Starch was extracted by the moist method and the chemical composition of starch was studied. The plant sources differed in chemical content, and was observed increasing in moisture significantly for potato starch (12.2%) as compared with sorghum and rice starch, while the superior content of the rice starch was in protein, fat and carbohydrates (1.45 and 0.33 and 90.87)% respectively, and the highest of ash was found in sorghum starch 0.52%.

Then the extracted starch was modified from its primary sources physically by the moist thermal treatment and chemically by cross linkages. The physical characteristics of modified starch were studied, and the results were as the following:

- Each of the natural and modified starch from various sources in the physical properties, it was observed increasing in the solubility of the natural starch granules of potatoes, sorghum and rice from the modified starch granules. The solubility was increased gradually by increasing of the temperature, the highest solubility was found in the natural starch granules (6.2, 7.4 and 6.35) % respectively at temperature of 90 °C , and (6.14, 6.87 and 6.13)% respectively in the modified starch granules by moist thermal method, and (5.4, 5.28 and 5.99)% respectively in the modified starch granules by cross linkages, while increasing in the swelling of the natural starch granules to each of potatoes, sorghum and rice starch as compared with the modified starch granules and increasing the swelling gradually by increasing the temperature. The highest swelling was found in the natural starch granules (10.35, 10.18 and 10.17) gram/gram respectively at temperature of 90 °C , while for modified starch samples by moist thermal method which reached (9.25, 9.22 and 9) gram/gram respectively and samples of the starch modified by cross linkages reached (8.97, 8.98 and 8.55) gram/gram respectively.

- The percentage the percentage of phosphorus in the natural starch extracted from its primary sources was significantly at ($P \leq 0.05$) with the modified starch varied chemically by cross linkages as the superiority of the modified potato starch with highest which reached 0.39% .

Active groups of chemically modified starch molecules have been identified diagnosed by FT-IR apparatus, as the presence of a band at wave length (998.411 ,99864 and 1020.64) cm^{-1} respectively, which belongs to the elasticity vibrating for the bound C-O-P .

The procedure of the Microencapsulation packaging for *L.plantarum*, *L.caise* and *L.acidophilus* was done by three different mixtures with concentrations ranged between (1-3)% each of sodium alginate, natural and resistant starch both individually, and found that the best mixture was when used a combination of sodium alginate and resistant starch at concentration 2% for each (mixture A), and used the starters *Streptococcus thermophilus* and *Lactobacillus delbrueckii* subsp *bulgaricus* in the manufacture of the yoghurt and mixed with the starter of yoghurt, examined the change in the pH and titrating acidity for yoghurt product during different periods of storage at temperature of 4 °C and study the change in the logarithm of the live numbers during the storage period extended for 28 days.

The effect of the packaging process on the survival, Bacteria was studied and the results were as showed the following :

- It was found that the resistance of coated bacteria using a combination of sodium alginate and starch resistant with concentration of 2% for each of them was the best of free bacteria resistance when exposed to low acidic conditions which reached 2.5, 2 and 1.5 , and particularly at the third hour of incubation as a percentage decline in live numbers logarithm / ml 34.76, 39.61 and 44.83% respectively, to *L.plantarum* bacteria and 36.25, 41.89 and 46.86% respectively, to *L.caise* bacteria and 35.35 , 41.84 and 45.78%, respectively, to *L.acidophilus* bacteria. As well as observed that the resistance of bacteria coated to different concentration of the yellow salts reached 0.1 , 0.2 and 0.3% was higher than the resistance of free bacteria after three hours of incubation as a percentage decline in live numbers logarithm / ml 2.54, 3.34 and 4.19% respectively to *L.plantarum* bacteria , and 2.87 ,3.78 and 4.60% respectively to *L.caise* bacteria , and 2.93,3.97 and 4.77% respectively to *L.acidophilus* bacteria .

- coated bacteria showed better resistance during the process of freezdrying compared with free bacteria as a percentage decline in live numbers logarithm / ml 2.24, 3.01 and 4.16% respectively to *L.plantarum* bacteria , and 2.09, 3.34 and 4.47% respectively to *L.caise* bacteria , and 2.19,3.29 and 4.58% respectively to *L.acidophilus* bacteria .