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SEPARATION OF WHEY BY MEMBRANE DISTILLATION

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Introduction

In the dairy industry in the production of protein and fat products (cottage cheese, cheese, casein), about 90% of the volume of processed milk goes into whey. Despite the value of the components (whey proteins, lactose), included in its composition, whey in most companies is merged into the drain. This is due to the use of obsolete energy technologies, which have been known for over 40 years [1].

Recently, the studies of membrane distillation process have been ever increasing [2]. This is due to the following benefits: the ability to concentrate the target components to the limit of their solubility at low temperatures, lack of positive pressures and vacuum (except for vacuum membrane distillation) in working chambers, simplicity of construction plants, developed mass transfer area, etc.

The aim of present paper was: the identifying of specific performance of membranes dependences on the content of dry matter.

Experiments

For investigations of membrane distillation hydrophobic porous MFFK-3 membranes ("Vladypor", Russia) were selected which are of an average pore size of 0,45 μm [3], and have the highest productivity in comparison with other series MFFK membranes [4]. We found out that selectiveness of MFFK-3 membranes by sodium chloride (NaCl) during membrane distillation process was more than 99,7 % [5].

Whey, obtained at an industrial enterprise during the production of milk cheese, at first was cleared from the remnants of milk fat and casein dust by microfiltration. Next, the filtrate was pasteurized, heated at 345±2 K with holding for 1...20 s and subsequent quenching to a temperature of 288-293 K. Serum proteins were separated with the help of circulation ultrafiltration settings, with plate UPM-50 membranes ("Vladypor", Russia).

Laboratory setup [6] consisted of two circulation paths: "hot" and "cold". Depending on the purpose of the experiment, "hot" solution was supplied to the upper or lower chamber of membrane cell, cell location was changed relatively to a changing field of gravitation forces (horizontal or vertical position). Volume velocity of solution was 0,025 dm^3 sec^{-1}.

Results and Discussion

At the start of separation, when the content of dry matter in whey (after the separation of protein compounds by ultrafiltration) is about 5 %, specific performance is by 12 % higher on the average if the "hot" chamber is under the membrane, but not above it. However, this difference decreases in proportion to the increase of mass fraction of dry matter, which is obviously due to the increased viscosity of the solution. The latter phenomenon slows down the transfer of matter by natural convection in the volume of working chamber [7] and therefore reaching 35-40 % of solids in whey the "hot" chamber position relatively to membrane practically has no affect on specific performance.

It is found out experimentally that by membrane distillation the ultrafiltrate of whey can be concentrated to solids content by 50-58%, what allows to recommend this process in lactose production technologies.

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