

## Encapsulated Rennin Enzyme in Nano and Micro Tubular Cellulose/Starch Gel Composite for Milk Coagulation

**Authors :** Eleftheria Barouni, Theano Petsi, Argyro Bekatorou, Dionysos Kolliopoulos, Dimitrios Vasileiou, Panayiotis Panas, Maria Kanellaki, Athanasios A. Koutinas

**Abstract :** The aim of the present work was the production and use of a composite filter (TC/starch), containing rennin enzyme, in continuous system and in successive fermentation batches (SFB) for milk coagulation in order to compare the operational stability of both systems and cheese production cost. Tubular cellulose (TC) was produced after removal of lignin from lignocellulosic biomass using several procedures, e.g. alkaline treatment [1] and starch gel was added for the reduction of TC tubes dimensions to micro- and nano- range[2]. Four immobilized biocatalysts were prepared using different ways of the enzyme entrapment. 1) TC/ rennin (rennin entrapped in the tubes of TC), 2) TC/SG-rennin (rennin entrapped in the tubes of the composite), 3) TC-SG/rennin (rennin entrapped into the layer of starch gel) and 4) TC/rennin- SG/rennin (rennin is entrapped both in the tubes of the TC and into the layer of starch gel). Firstly these immobilized biocatalysts were examined in ten SFB regarding the coagulation time and their activity. All the above immobilized biocatalysts remained active and the coagulation time was ranged from 90 to 480, 120-480, 330-510, and 270-540 min for (1), (2), (3), and (4) respectively. The quality of the cheese was examined through the determination of volatile compounds by SPME GC/MS analysis. These results encouraged us to study a continuous coagulation system of milk. Even though the (1) immobilized biocatalyst gave lower coagulation time, we used the (2) immobilized biocatalyst in the continuous system. The results were promising.

**Keywords :** tubular cellulose, starch gel, composite biocatalyst, Rennin, milk coagulation

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