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学位論文の概要及び要旨

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題　　目　Microencapsulation of *S*-adenosyl-L-methionine in sake yeast by spray drying
（噴霧乾燥法によるサケ酵母中の*S*-アデノシル-L-メチオニンのマイクロカプセル化）

学位論文の概要及び要旨

S-Adenosyl-L-methionine (SAM) is an important biochemical molecule in all living organisms. It involves in the methylation of target molecules as DNA, proteins, lipids and polyamines synthesis, and also participates in a number of biochemical reactions including transmethylation, transsulfuration and biosynthesis of polyamines. Given the importance of SAM in tissue function, this molecule is being investigated as a potential therapeutic agent for the treatment of various clinical disorders. Despite the increasing demand of SAM in the pharmaceutical and chemotherapeutic fields, the problem remains that SAM is an unstable substance, highly reactive and very hygroscopic (moisture or heat can quickly degrade it) since it undergoes cleavage to 5'-methylthioadenosine (MTA) and homoserine lactone, which are accelerated above room temperature. Conventional approach to prepare SAM is by fermentation or enzymatic methods, and attempts to produce SAM by culturing microorganisms in medium enriched L-methionine were reported.

In this research, the aim is to study the formation of SAM powder by spray drying. Effects of spray drying conditions such as the type of carrier solid and the inlet air temperature on SAM retention were investigated. The storage stability of SAM powder was also studied. The SAM sample that we focused on was SAM-Cl (commercial form), and SAM yeast (*Saccharomyces cerevisiae* Kyokai No. 9). The pH and thermal stability of SAM both in SAM-Cl solution and yeast solution were also determined.

In SAM-Cl solution, the degradation rate of SAM could be estimated as first-order degradation kinetics. SAM was quite stable under slightly acidic conditions (pH 3.0-5.0) and at low temperature (20-25 °C). In SAM yeast solution, at higher incubation temperature the degradation rate of SAM could be estimated as zeroth-order degradation kinetics.

Spray drying of the samples were carried out in a Büchi mini spray dryer B-290, at various inlet air temperature. SAM was extracted by 10% perchloric acid and quantified using HPLC (UV-VIS detector). Moreover, the effects of various additives on the retention of SAM in spray-dried powder were also observed in the presence of mannitol, trehalose and maltodextrin.

For SAM-Cl powder, the highest SAM retention was obtained when maltodextrin (DE = 25) was used as carrier solid. For SAM yeast, the optimum retention of SAM on the spray drying was obtained at 120°C inlet air temperature. The SAM yeast powder with trehalose and maltodextrin

(DE = 25), used as carrier solid, exhibited higher stability of SAM.

The water content in the powder had a significant effect on the stability of SAM. The SAM powder at lower water content exhibited higher stability of SAM.

Lastly, microfuidization 1 pass, was selected to disrupt sake yeast with 80% extracted efficiency when compare with the extracted achieved by 10% perchloric acid. In addition, the methionine addition at 24 h during fermentation of SAM yeast can improve SAM production from sake yeast about 34%.