Surfactin production on the rapeseed cake during solid-state fermentation with new design SSF bioreactor

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1. Introduction -Solid state fermentation (SSF) is one of the biotechnology research method used for producing various products on an industrial scale. It has many advantages in this: utilize a waste from other industries; minimalize costs of processing by using a less water and heating energy or re-use of treated the substrates (e.g. like a feed additive).

Bacillus subtilis (*BS*) is a microorganism which produces three kinds of lipopeptides with the difference in the hydrophilic part: iturin, surfactin and fengycin [1].

Surfactin (SU) is one of the most known lipopeptides produced by *B. subtilis*. This biosurfactant has strong emulsifying, antimicrobial and antiviral properties. Our *BS* strain KB1 isolated from Natto meal bacterial culture starter, produced a mixture of at least five SU's structural homologues with the b-hydroxyl fatty acids tails ranging from C12 to C16 [2].

The aim of this study was design and production of lipopeptides in SSF with new bioreactor. Our device is composed of four independent fermentation chamber with heating and pumps for air and water controlled by the central computer- data collector, what helps in an optimization of the SSF process. Our system can collect data about temperature changing, O_2 to CO_2 ratio changing during fermentation and after fermentation we could measure the moisture of the final product.

2. Experimental - Preliminary researches of SSF SU production was performed using the glass 15 mL test-tubes with various air: sample ratios [3] and the 300 mL flasks with filling volume ~20% of rapeseed meal inoculated with the volume range from 0,5:1 to 2:1 volume/mass ratio of 0,2 optical density (OD_{600}) Modified Landy's Medium PJ culture of *BS* KB1.

3. Results and Discussion – First results published by Jajor et al. (2016) showed the influence of variable sample: air ratio on the amount of produce biosurfactant, additionally by using a different aeration can we get a different final composition of SU homologues. Chart I. shows how the change in inoculum volume affects the amount of raw biosurfactant extracted from rapeseed cake.

4. Conclusions – Surfactin occurs as a mixture of structural homologs. The obtained results show that by controlling the fermentation process, it is possible to indirectly influence the quantity and quality of the obtained surfactin, which would allow producing individual homologues. The use of an SSF type bioreactor carrying out four independent experiments at the same time will allow to reduce the time needed to optimize the production process based on a solid substrate, at the same time facilitate the transfer of working conditions from laboratory scale to production scale

4. References

[1] Janek T et al. (2013) Lipopeptide biosurfactant pseudofactin II induced apoptosis of melanoma A 375 cells by specific interaction with the plasma membrane. PloS one **8** (3) e57991. http://dx.doi.org/10.1371/journal.pone.0057991

[2] Jajor P et al.(2016) Surfactin analogues produced by *Bacillus subtilis* strains grown on rapeseed cake. Journal of Molecular Structure. http://dx.doi.org/10.1016/j.molstruc.2016.02.014