

In order to increase bioavailability of sunflower protein, enzymatic hydrolysis with industrial enzymatic compositions was suggested as a preliminary stage. Five industrial proteases (Fermgen, Proteinase T, Protex 40E, Protex 51 FP, Protex 7L) were tested for fermentation media preparation. The aim of this study was testing the possibility of a potential fermentation process on sunflower protein isolate enzymatic hydrolysates. Sunflower protein isolate enzymatic hydrolysates not only accelerated the bacteria growth, and should be promising in further enhanced vitamin B12 and B2 biosynthesis. *B. megaterium* fermentation on medium composed of sunflower protein isolate treated with acidic proteinase Fermgen as well as alkaline endopeptidase Protex 7L demonstrated the highest bacteria growth, which means they could be good candidate for industrial production of fodder enriched with vitamin B12 and riboflavin.

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References

- Barbau-Piednoir E. et al. Genome sequence of EU-unauthorized genetically modified *Bacillus subtilis* strain 2014-3557 overproducing riboflavin, isolated from a vitamin B2 80% feed additive //Genome Announc, vol.2(3), e00214-15, 2015.
- Baron F. et al. Rapid and cost-effective method for micro-organism enumeration based on miniaturization of the conventional plate-counting technique //Le Lait, Vol 86 (3), 251-257, 2006.
- Baurin D. V., Gordienko M. G., Panfilov V. I., Shakir I. V. Sunflower meal processing for protein isolates and fodder additive //Chemical Engineering and Biochemical Engineering for a new sustainable process industry in Europe, Vol 1, 912, 2015.
- Biedendieck R. et al. Metabolic engineering of cobalamin (vitamin B12) production in *Bacillus megaterium* //Microbial biotechnology, Vol 3 (1), 24-37, 2010.
- Brown J.H. The formal titration of bacteriological media // J. Bacteriol. American Society for Microbiology (ASM), Vol 8 (3), 245, 1923.
- Chung H. J., Fields M. L. Production of riboflavin and vitamin B12 by *Bacillus megaterium* ATCC 13639 and *Enterobacter aerogenes* in corn meal //Journal of food science, vol.51(6), 1514-1517, 1986.
- Fang H. et al. Metabolic engineering of *Escherichia coli* for de novo biosynthesis of vitamin B 12 //Nature communications, Vol 9 (1), 4917, 2018.
- Kang Z. et al. Recent advances in microbial production of δ -aminolevulinic acid and vitamin B12 //Biotechnology advances, Vol 30 (6), 1533-1542, 2012.
- Karetkin B. A. et al. New integrated technology of probiotics production using cereal hydrolysates //International Multidisciplinary Scientific GeoConference: SGEM: Surveying Geology & mining Ecology Management, vo. 18, 393-400, 2018.
- Kuhn R., György P., Wagner-Jauregg T. Über Ovoflavin, den Farbstoff des Eiklars //Berichte der deutschen chemischen Gesellschaft (A and B Series), vol.66(4), 576-580, 1933.
- Loman A. A., Islam S. M. M., Ju L. K. Production of arabitol from enzymatic hydrolysate of soybean flour by *Debaryomyces hansenii* fermentation //Applied microbiology and biotechnology, Vol 102 (2), 641-653, 2018.
- Mardawati E. et al. Production of xylitol from corn cob hydrolysate through acid and enzymatic hydrolysis by yeast //IOP Conference Series: Earth and Environmental Science, Vol 141 (1), 12-19, 2018.
- Martens J. H. et al. Microbial production of vitamin B 12 //Applied microbiology and biotechnology, Vol 58 (3), 275-285, 2002.
- Miller G. L. Use of dinitrosalicylic acid reagent for determination of reducing sugar //Analytical chemistry, Vol 31 (3), 426-428, 1959.
- Mohammed Y. et al. Development of a two-step cultivation strategy for the production of vitamin B12 by *Bacillus megaterium* //Microbial cell factories, Vol 13 (1), 102, 2014.
- Nuseed Europe. Global trends in sunflower production, 16 Apr. 2019, <https://www3.nuseed.com/eu/global-trends-in-sunflower-production/>. Accessed 19 november 2019.
- Schwechheimer S. K. et al. Biotechnology of riboflavin //Applied microbiology and biotechnology, Vol 100(5), 2107-2119, 2016.
- Taranto, M. P. et al. *Lactobacillus reuteri* CRL1098 produces cobalamin //Journal of bacteriology, vol.185 (18), 5643-5647, 2003.
- Watanabe F., Bito T. Vitamin B12 sources and microbial interaction //Experimental Biology and Medicine, Vol 243 (2), 148-158, 2018.