The Torch
Vol. 2 (14)

Single-cell protein from wastes for combating environmental pollution

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Single-cell protein (SCP) technology dates back a century, which was initially introduced to counteract the food shortages during the war but later on it was produced in surplus to address the hunger and malnutrition problems. SCP refers to the microbial cells (yeast, fungi, algae, and bacteria) or total protein extracted from pure microbial cell culture, which can be used as a protein supplement for humans or animals. SCP used for human consumption is considered as food grade; whereas, SCP used for the animal supplement is considered as feed grade. SCP possesses high protein content that ranges between 60-80% and it also contains fats, nucleic acids, carbohydrates, vitamins and minerals. The waste products formed in various industries, such as molasses, whey, rice or corn straw, animal manures, etc. that largely contribute to the environmental pollution could be successfully utilised as raw materials for its production. The technology and microorganisms employed for SCP production depend on the wastes being used.

Symba process is a novel technology where SCP is produced by processing the starch waste. Since the proportion of the available substrate is starch many microbes cannot directly utilise hence microorganisms that grow in a symbiotic association are selected and they are the two yeasts, namely Endomycopsis fibuligira, which produces the hydrolytic enzymes necessary for starch degradation, and Candida utilis, which grows on the hydrolysate to form biomass. The microbial biomass produced is separated by centrifugation and the SCP thus obtained is dried, packed and stored. The SCP produced in this process is of good nutritive value. To date, an abundance of reports about SCP production have appeared but research keeps on continuing on the approaches, such as utilisation of conventional substrates, and use of waste materials to bring about pollution control. SCP has made progress in terms of processing, finding new strains, developing new processes, etc. Recently SCP is being studied as a feed ingredient in aquaculture too owing to their high-quality protein ingredient. Advances in fermentation technology and genetic engineering related to SCP along with extensive feeding trials could re-evaluate SCP production and make it more competitive.

Keywords: Single-cell protein, Agricultural wastes, Human food, Animal feed, Microorganisms, Symba process, Aquaculture, Aquafeed

Citation:
Kaviya Sri K. Single-cell protein from wastes for combating environmental pollution. The Torch. 2021. 2(14). Available from: https://www.styvalley.com/pub/magazines/torch/read/single-cell-protein-from-wastes-for-combating-environmental-pollution.