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Perspective

Monascus Purpureus Use in Submerged Fermentation to Produce Red Pigment

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DESCRIPTION

Utilization for Red Pigment Production by *Monascus Purpureus* in Submerged Fermentation Colour conveys information about a category of goods and certain brands, producing useful visual suggestions to demonstrate attractiveness, tastes, distinctiveness, and innovation in packaging. In response to the growing public impression that natural pigments are safer, food companies have chosen to utilise natural colours rather than synthetic ones. Plant-derived pigments have some drawbacks, including limited water solubility, instability in the presence of heat and light, high cost, and the need for extensive agricultural lands. However, microbial pigments have a number of advantages to chemically synthesised pigments, including being less dependent on seasonal variations, using less expensive raw materials, being biodegradable, and having a wider range of colour tones. As a result, bio-pigments made by microorganisms are preferred for use in food industry. Thus, the food sector prefers microbial pigments known as bio-pigments since they are safer. Since the manufacture of synthetic pigments is more linked to health issues like carcinogenicity and teratogenicity, the development of microbial pigments has been gradually rising.

Monascus Purpureus, a fungus that has been identified from red-fermented rice in Indonesia, is one of the many organisms that produce colour. The manufacture of fermented foods in Asian nations, including southern China, Japan, and Southeast Asia, has heavily favoured this filamentous fungus. As secondary metabolites, *Monascus Pigments* (MPs) have a variety of health benefits, including antioxidant, anti-inflammatory, antibacterial, anticarcinogenic, and antimutagenic properties. Red, orange, and yellow are the primary colour pigments generated by *Monascus spp*. in polyketone structures. Rubropunctamine ($C_{21}H_{26}NO_4$) and Monascorubramine ($C_{23}H_{27}NO_4$) are the names of the red pigments in those six primary colours, while Rubropunctatin ($C_{21}H_{22}O_5$) and Monascorubrin ($C_{23}H_{26}O_5$) are the names of the orange and yellow pigments, respectively. In many different types of foods (red wine, tofu, surimi, sausage, ham, different sauces, noodle products, ready meals, meat products, etc.), particularly in East Asian countries, monascus pigments are employed as food additives, colour thickeners, or nitrite substitutes. Dairy, textile, and cosmetics industries all have application areas.

The wastes produced by the food industry seriously damage the environment and contribute to global warming. The recovery and reuse of these wastes as resources within the circular economy cycle is one of the main criteria for sustainable industrial production. As a result, studies about the use of food industry wastes in the creation of high-value biotechnological products have received a lot of attention from researchers in recent years. Utilizing carbon and nitrogen-containing wastes in bioprocesses is crucial for lowering environmental pollution and creating low-cost, reliable, and sustainable production systems. It has been reported in the literature that Monascus pigments were made from various food industry leftovers. These include grape pulp, corn step liquor, Jack fruit wastes, wheat, hydrolyzed rice straw, waste beer, brewer's spent grain, orange peels, chicken feather, sugarcane bagasse, bakery wastes, rice water based medium, sweet potato, corn cob, and prickly pear juice.

Whey, a byproduct of the production of cheese, casein, and yoghurt, is seen as waste in the dairy sector. Whey is a low-value byproduct that, after further processing, is employed as a substrate in microbial fermentations that use lactose. However, when discharged directly into water receiving bodies, it is classified as an ecologically damaging and the most polluting waste. Dairy processing is typically regarded as the major industrial food wastewater source, especially in Europe, because to the tremendous industrialization seen in the last century and the increase rate of milk production (about 2.8% per year).

A tonne of milk yields 150 kg–200 kg of cheese, while 800 kg -850 kg of whey is generated, depending on the type of cheese and the method of production. The yearly global production of whey is between 180 and 190 million tonnes. Due to its extremely high biological (BOD > 35,000 ppm) and chemical oxygen demands (COD > 60,000 ppm) as well as its low pH, it poses a serious hazard to the ecosystem. The industry spent a lot of time in the 20^{th} century developing low-cost whey removal methods, such as discharging it into fields or into waterways, the ocean, or

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municipal sewage treatment facilities. These disposal techniques are currently prohibited by stringent environmental rules. Whey treatment and/or recovery for use in the creation of value-added goods have grown to be a significant concern. There has been numerous on the use of whey as a substrate in bioprocesses because it contains 4.5%–5.0 % lactose, 0.6% –0.8% protein 0.4% –0.5% fat, vitamins, and minerals. Some bioprocesses requires the hydrolysis of lactose into its monomers,glucose and glactose by the enzyme-galactosidase because some microbes cannot use lactose in whey as the carbon source.