Antioxidant Capacity of *Aspergillus niger*: Enhancing with Fermentation Efficiency

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Commentary

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DESCRIPTION

Malic acid is widely used in the food industry as a flavour enhancer, acidulant and metal cleaning paint in the daily chemical industry. Malic acid is one of the building blocks used in the synthesis of biodegradable polymers. Malic acid is being used more frequently in the global industry and the yearly market is predicted to exceed one lakh tonnes. Malic acid is mostly produced through enzymatic means with fumarate hydratase converting water and fumaric acid into malic acid. Fumaric acid was often generated from petroleum-based sources, which could provide possible safety risks in the finished product. Microbial fermentations to manufacture malic acid can use a wide range of renewable substrates and microorganisms, making the process far more versatile and independent of fossil resources. As a result, microbial fermentation to create malic acid has received a lot of attention in recent years. A variety of methodologies have been investigated in order to gain industrial applicability for malic acid fermentation.

There is intracellular stress in the process of microbial production, which is mostly caused by oxidative stress, product inhibition and nitrogen limitation, ultimately decreasing microorganism fermentation performance and lengthening fermentation time. For example, oxidative stress reduced yeast's capacity to utilise pentose. The acidic fermentative products or by-products impeded the growth and production of *Escherichia coli*. Furthermore, nitrogen limitation stresses that above a particular threshold fumaric acid reduces synthesis in *Rhizopus oryzae*. As a result, reducing stress is critical to ensuring the productive robustness of the cells.

Peptide supplementation has been shown to promote product accumulation and stress relief in microorganisms. Soy peptides could boost *Saccharomyces cerevisiae* cell growth under low-temperature stress conditions. Collagen peptide could greatly improve *Saccharomyces cerevisiae* stress tolerance to product inhabitation, hence increasing bioethanol production. The use of peptides could reduce stress and increase efficiency in *Rhizopus oryzae* during organic acid production. Furthermore, the particular mechanisms underlying the enhancement of product accumulation by exogenous peptide addition remain unknown. The physiological and molecular processes of stress tolerance generated by peptides and a stress tolerance strain was developed to address the issue of long fermentation duration. Initially showed that peptides, particularly elastin peptide, may effectively boost the efficiency of malic acid fermentation. Transcriptome sequencing and biochemical assay analyses were then used to illustrate the probable mechanism of the elastin peptide in fermentation.

Aspergillus niger is a mould in the *Aspergillus* genus that belongs to the Nigri section. The *Aspergillus* genus is made up of common molds found in soil, water, vegetation, decomposing debris and suspended in the air. This genus species develop swiftly and can sporulate within a few days of germination. A combination of *Aspergillus niger* properties makes the organism invaluable in the manufacture of numerous acids, proteins and medicinal substances. *Aspergillus niger* robust production of secondary metabolites is due to characteristics such as vast metabolic diversity, high production yield, secretion capabilities and the ability to execute post-translational modifications. The ability of *Aspergillus niger* to endure extremely acidic conditions makes it particularly significant in the industrial manufacture of citric acid.

To combat reactive oxygen species-mediated oxidative stress, organisms have devised a variety of techniques. A catalase expressing gene might protect *Saccharomyces cerevisiae* cells from severe oxidative stress, whereas deletion of a catalase encoding gene in *Aspergillus niger* increased oxidative stress susceptibility. After the addition of elastin peptide, the amount of reactive oxygen species was reduced and the fermentation efficiency of *Aspergillus niger* was greatly increased. The RNA-sequence and RT-qPCR analyses revealed that elastin peptide increased gene expression, implying that elastin peptide may activate the antioxidant pathway of *Aspergillus niger* to alleviate the adverse harsh fermentation conditions. As a result, it is hypothesised that increasing *Aspergillus niger* antioxidant capacity was linked to increased fermentation efficiency.