

Unconventional methods for enhancing the fermentation process

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Bioethanol, the most widely used biofuel, can be obtained by the fermentation of glucose. In order to reduce production costs, new methods for enhancing the fermentation process must be identified.

Microwaves are mostly used for the destruction of microorganisms (food sterilization at low temperatures)^{1,2}. Few information are available regarding the possibility to enhance biological processes through exposure to microwaves^{3,4,5}.

The fermentation process of glucose with *Saccharomyces cerevisiae* under continuous exposure to microwaves was studied. A multimode applicator was used, in which the microwaves are provided by a solid state microwave generator with a maximum power of 20 W. This type of construction allows the exposure of the fermentation broth to controlled small doses of microwaves. Microwave irradiation, the cooling and stirring of the reaction mixture were carried out simultaneously, in order to maintain the temperature constant during the fermentation process. Temperature distribution in the reactor was verified both experimentally and by process modelling using Comsol Multiphysics®.

The effects of microwave irradiation on fermentation rate and yeast cell growth were observed during the fermentation process, at different glucose and yeast concentrations. The optimal specific absorption rate (SAR = 25 W/kg) was identified, at which the fermentation rates were up to 40 % higher than those obtained in the conventional process carried out at the same conditions but in the absence of microwaves.

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