



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

This thesis has addressed important fundamental issues in ultrasound-assisted food processing of liquid systems. An attempt has been made for intensification of product yield by application of sonication to the conventional food processing techniques. Three food processes, viz. extraction (astaxanthin from *Phaffia rhodozyma*), fermentation (riboflavin from *Debaryomyces hansenii* var. *hansenii*) and crystallization (lactose monohydrate) were studied in this thesis work. Previous literature has already reported beneficial action of ultrasound on these processes for increasing product yield or faster kinetics. However, the missing link was the physical mechanism of the process, i.e. the connections between basic mechanics of the process and physics of sonication. An attempt has been made in this thesis to fulfill this research gap with basic approach of coupling experimental results to simulations. The results of this thesis research have shed light on intricate links between physics of ultrasound and cavitation, and the physics of the basic process. A peculiar feature of this thesis is that in all studies, the natural strains and isolates of microbial strains have been used. This is in view of their stability and sturdiness in open natural environment. An important outcome of this thesis is the strong influence of mass transfer on the process. Thus, the key to intensification of these processes is enhancement mass transfer characteristics of the system. Looking at the prevalent mechanics for all processes that has become evident from this thesis; the physical effects of sonication – i.e. generation of intense microconvection - are relevant for enhancing efficiencies of food processes. This microconvection is able to enhance mass transfer in microscale systems (bacterial cultures or lactose crystals etc.), which is manifested in terms of faster kinetics with higher yield. A key revelation of the thesis (which has not been reported in previous literature) is the

intra-cell influence of sonication in terms of overexpressions of genes corresponding to different enzymes in metabolic pathway. This effect is underlying the enhanced productivity of natural isolates of bacterial cultures – at par with genetically modified strains.

