ABSTRACT

Abeer El-Sayed Abd El-Fattah, Microbial Production of Emulsifiers for the Utilization in Dairy Products. Unpublished Doctor of Philosophy Thesis, Ain Shams University, Faculty of Agriculture, Department of Food Science, 2006.

The main objective of this study was to produce bioemulsifier from yeast that could potentially be used in food and dairy industries and many other applications.

The heat extraction procedure allowed the isolation of emulsifying agent from all of the eleven yeast strains tested. *Saccharomyces cerevisiae* EMCC 69 strain produced the highest bioemulsifier yield with superior emulsification activity. Some yeast strains such as *Candida utilis* EMCC 120 produced higher extracellular bioemulsifier yield and activity, than that recorded for Glycerol monoleate as a control emulsifying agent. For this reason, and due to long history of safe human consumption, *Saccharomyces cerevisiae* EMCC 69 *Candida utilis* EMCC 120 were chosen for further studies.

The highest production of intracellular bioemulsifier in modified Czapek, s yeast broth by *S. cerevisiae* EMCC 69 strain was achieved with initial pH 7, inoculum level of 5%, agitation rate of 200 rpm, fermentation at 30oC for 72 h.. The highest production of extracellular bioemulsifier in modified Czapek, s yeast broth by *C. utilis* EMCC 120 strain was achieved with initial pH 7, inoculum level of 3%, agitation rate of 400 rpm, fermentation at 30oC for 60 h. Scale-up fermentation enhanced the yield of exteracellular bioemulsifier of *Candida utilis* EMCC 120 and intracellular bioemulsifier of *Saccharomyces cerevisiae* EMCC 69. This means high yield of

exteracellular and interacellular bioemulsifiers with low production costs.

The pH of aqueous phase had little effect on the amount of the butter oil phase emulsified by *Candida* emulsifier between pH 2 and 11. Stability of emulsions with *S. cereviciae* EMCC 69 emulsifier decreased with increasing pH values over 6. In the presence of 1 to 5% (w/v) sodium chloride, there was no loss of emulsion stability occurred. Stable emulsions were formed in the presence of up to 15% (w/v) sucrose. Emulsion for both of *S. cereviciae* and *C. utilis* emulsifier stability was 79% after three cycles of freezing at –18 ^{o}C for 16 h and thawing at 32^{o}C for 8h. Emulsions with *S. cereviciae* EMCC 69 and *C. utilis* EMCC 120 were not disrupted by pasteurization at 63^{o}C for 30 min. Stability of emulsions did not change during storage at 4oC for 30 days. Much loss in emulsion stability during storage at room temperature 25^{o}C for 15 days was observed. Emulsifiers extracted from *S. cereviciae* EMCC 69 and *C. utilis* EMCC 120 emulsified all oils tested.

High quality ice cream and whipped cream with preferable texture and consistence, were produced with adding 0.2% or 0.3% bioemulsifiers, respectively.

Key words: Yeast, emulsifier, emulsification activity, emulsification stability, ice cream, whipped cream.

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LIST OF ABBREVIATIONS

AOAC	Association of Official Analytical Chemists
ATCC	American Type Culture Collection
ºC	Degree centigrade
CMC	Sodium carboxy methylcellulose
cfu	colony forming unit
cfu/ml	colony forming unit per milliliter
DCW	Dry cell weight
DM	Dry matter
DSM	Deutsch Sammlung von Mikroorganismen
EMCC	Egyptian Microbiology Culture Collection
EXBE	Extracellular bioemulsifier
eta	Egyptian Office for Trading and Agencies
et al	and others (et alii)
g/g	gram per gram
g/l	Gram per liter
GMO	Glycerol monoleate
h	Hour
IBE	Interacellular bioemulsifier
kDa	Kilo dalton
min	minute
MIRCEN	Microbiological Resources Center
ml	Milliliter
N CYC	National Collection of Yeast Cultures
NRRL	Northern Regional Research Laboratory
OD_{600}	Optical density at 600 nm
r.p.m.	Revolution per minute

SAS	Statistical Analysis System
sec	Second
SNF	Solids not fat
sp. gr.	Specific gravity
TA	Titratable acidity
TBC	Total bacterial count
temp.	temperature
TN	Total nitrogen
UF	ultrafilitration
%	percentage
wt	weight
W / gal	Weight per gallon