ABSTRACT

Ahmed Hassanien Sallam Soliman: Evaluation and Application of Carotenoids Produced from Food Wastes by Some Microorganisms. Unpublished M.Sc. Thesis, Department of Food Science, Faculty of Agriculture, Ain Shams University, 2009.

The objective of the present study was to use the agro-food processing wastes (guava pomace, sugar cane bagasse and corn cobs), after hydrolysed by acid, as a carbon sources for carotenoid production by isolated yeasts. Pigmented yeasts were isolated from different plant leaves: tomato, maize, cotton, soy bean and sunflower leaves. Identification of the yeast isolates were performed through morphological and reproduction characteristics, along with physiological and biochemical tests. All yeast isolates were identified as *Rhodotorula glutinis* species. Trails for studying the carotenoid productivity of the wild strain *R. glutinis* were carried out in 4 media (glucose medium, guava pomace hydrolysed, sugar cane bagasse hydrolysed medium and corn cobs hydrolysed medium) and the effects of nutritional requirements (carbon concentrations, nitrogen sources and mineral sources) and environmental conditions (incubation period, initial pH, incubation temperature and aeration rate) were also studied. The maximum carotenoids production achieved by *R. glutinis* in sugar cane bagasse medium was 6.895 mg/l at the optimum conditions (3 % total reducing sugar, 1 % yeast extract, 0.2% $MgSO_4.7H_2O$, pH 6, incubation temperature 30 ^{0}C and aeration rate 175 rpm after 120 h). The wild strain of *R. glutinis* was subjected to mutagenesis using UV radiation (254 nm) for 5 min. a mutant labelled as M1 and M2. In *R. glutinis* M1, the highest production of dry cell weight, volumetric carotenoid production and cellular carotenoid accumulation were 15.28 g/l, 7.237 mg/l and 474 µg/g dry yeast. While in *R. glutinis* M2, the highest production of dry cell weight, volumetric carotenoid production and cellular carotenoid accumulation was 16.52 g/l, 7.516 mg/l and 454 µg/g dry yeast. Under the optimal condition of sugar cane hydrolyzed medium, carotenoid production of wild and its mutant were

examined during batch cultivation, the total carotenoid production was 8.823 and 8.562 mg/l by the mutant M1 and M2, respectively, while wild type yielded 6.895 mg/l of carotenoids.

The antioxidant activity of the yeast carotenoid extract was assessed by the 2, 2-diphenyl-1 picryl-hydrazil (DPPH) radical scavenging test antioxidant activities in linoleic acid system. Results showed that DPPH radical scavenging activities (%) were increased with increasing concentration of carotenoid extracts from 100 to 1100 µg/ml and it was 91.82 ± 0.12% in the presence of 1000 µg/ml. The percent of peroxide inhibition from linoleic acid at 40 ^{0}C was 64.2 % in the presence yeast carotenoid extract, while it was 73.51 and 68.71 % for BHT and TBHQ, respectively, after 12 days.

The potential application of the yeast carotene extracts in sun flower oil as antioxidant and in hard candy and gelatine jellies as a natural colour was evaluated. Lower levels of carotene extract (50 and 100 ppm) had an antioxidant effects on the stability of sunflower oil, which had induction periods of 8.40 and 8.75 hours, respectively. The hard candy and gelatine jellies prepared with carotene extract at level 1 and 2 mg/100 g had the highest values of color, appearance and overall acceptability in comparing with those prepared by adding 0.05 and 0.5 mg/100 g.

Key Words:

Isolation, Yeasts, Carotenoids, *Rhodotorula glutinis*, Agro food processing wastes, UV mutagenesis, Antioxidant activity, Sun flower oil, hard candy and gelatine jellies.

CONTENTS

LIST OF APPRIVIATIONS

%	Percentage
°C	Centigrade degree
µg	Microgram
$ABTS^{\cdot+}$ radical	2,2'-azinobis-(3-ethylbenzothiazoline-6-sulfonate)
ADF	Acid-detergent fiber
ADL	Acid-detergent lignin
ANOVA	Analysis of Variance
BHT	Butylated hydroxytoluene
CCH	Corn cobs hydrolyzed
CFU	Colony-forming unit
CTAB	Acetyl trim ethyl ammonium bromide
DBB	Diazonium blue B
Dept	Department
DMAPP	Dimethylallyl pyrophosphate
DMPO	5,5-dimethyl pyrroline N-oxide
DPA	Diphenylamine
DPPH	2,2-diphenyl-1-picrylhydrazyl
e.g	For example
$E_{1cm}^{1\%}$	Extinction coefficient
EDTA	Ethylene diamine tetracetate
EMS	Ethyl methyl sulphonat
et al	And others
FAO	Food and Agriculture Organization
Fig.	Figure
FPP	Farnesyl pyrophosphate
g	Gram
GGPP	Geranyl geranyl pyrophosphate
GPH	Guava pomace hydrolyzed
GRAS	Generally recognized as safe
h	Hour
HMG	β-hydroxy-β-methyl glutaryl CoA

HPLC	High performance liquid chromatography
i.e	That is (id est)
IPP	Isopenthyl pyrophosphate
kg	Kilogram
l	Liter
LDL	Low density lipoprotein
log	Logarithm
lx	Lux
LYCB medium	Liquid yeast carbon base medium
LYNB medium	Liquid yeast nitrogen base medium
MEA medium	Malt extract agar
mg	Milligram
min	Minute
ml	Millilitre
mm	Millimetre
MPa	Mega pixel
mv	Mill volt
MVA	Mevalonic acid
NDF	Neutral-detergent fiber
nm	Nano meter
NSG	Nitrosoguanidine
NTG	N-methyl-N′-nitro-N-nitrosoguanidine
OIP	Oxidation induction period
OSI	Oil stability index
PBN	α-phenyl butyl nitrone
PDA medium	Potato dextrose agar
PDA spectrum	Photodiode array
ppm	Part per million
PY1	Yeast isolated from tomato leaves
PY2	Yeast isolated from maize leaves
PY3	Yeast isolated from cotton leaves
PY4	Yeast isolated from soybean leaves

PY5	Yeast isolated from Sunflower leaves
rpm	Revaluation per minute
RSUO	Oxidative stability of refined sunflower oil
SAS	Statistical Analysis System
SCBH	Sugar cane bagasse hydrolyzed
Sci	Science
SDS	Sodium dodecyl sulfate
sp.	Specie
TBHQ	Tertiary butylhydroquinone
TLC	Thin layer chromatography
UV	Ultra violate
v/v	Volume per volume
vvm	Gas volume flow per unit of liquid volume per minute
w/v	Weight/volume
YM agar	Yeast malt extract agar
YM broth	Yeast malt extract broth
α	Alpha
β	Beta
γ	Gamma
ε	Epsilon