7URSLFDO -RXUQDO RI 3KDUPDFHXWLFDO 5HVHDUFK
,661 SULQW HOHFWURQLF
‹ 3KDUPDFRWKHUDS\ *URXS)DFXOW\ RI 3KDUPDF\ 8QLYHUVLW\ RI %HQLQ
$YDLODEOH RQOLQH DW KWWS ZZZ WMSU RUJ
KWWS G[GRL RUJ WMSU Y

2ULJLQDO 5HVHDUFK $UWLFOH

2SWLPL]DWLRQ RI *Clostridium tyrobutyricum* HQFDSVXODWLRQ E\ H[WUXVLRQ PHWKRG DQG FKDUDFWHUL]DWLRQ RI WKH IRUPXODWLRQ

0XKDPPDG 8PDU <DTRRE 0XKDPPDG =DEHHQ 3H]KL 3LQJ ;LDRMLQJ 6XQ <X\XH -LQ 4LXMLH /L +XD 7DQJ :DQJ +DLGRQJ :DQJ 0LQTL :DQJ
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Abstract

Purpose: To optimize the process parameters for the encapsulation of Clostridium tyrobutyricum (Ct) and to determine its in vitro characteristics.
Methods: The process parameters, including the concentration of the wall and hardening material, Ct to gelatin ratio and hardening time, were studied by single factor analysis, while optimization was performed by orthogonal experimental design for the encapsulation rate of Ct.
Results: Optimal conditions exhibited by orthogonal experimental design at a 92.17 % encapsulation rate with a viable count of 9.61 ± 0.06 lgCFU/g were: 6 % modified starch, 3 % sodium alginate, and 2 % $CaCl_2$ at a Ct to gelatin ratio of 1:1 with a hardening time of 30 min. The survival rates of encapsulated Ct were higher than free Ct in simulated gastric (6.22 %) and intestinal juices (15.55 %). Reduction in viable counts of Ct at 90 °C were higher for free cells (44.76 %) than encapsulated cells (28.09 %) after 30 min of heat treatment. Correspondingly, encapsulation boosted the capacity of Ct to withstand the strong acidic conditions of the stomach and improved the storage properties of Ct.
Conclusion: The results suggested that extrusion is a good technique for the encapsulation of Ct, as it enhances the viability of Ct during their transit through the gastrointestinal tract. Furthermore, encapsulation is favorable for Ct if planned for use in formulations where high temperature treatment is required.

Keywords: Encapsulation, Acid resistance, Bile salt tolerance, Clostridium tyrobutyricum, Extrusion, In vitro simulation, Temperature tolerance

7URSLFDO -RXUQDO RI 3KDUPDFHXWLFDO 5HVHDUFK LV LQGH[HG E\ 6FLHQFH &LWDWLRQ ,QGH[6FL6HDUFK 6FRSXV ,QWHUQDWLRQDO 3KDUPDFHXWLFDO $EVWUDFW &KHPLFDO $EVWUDFWV (PEDVH ,QGH[&RSHUQLFXV (%6&2 ,QGH[0HGLFXV -RXUQDO2 6HHN -RXUQDO &LWDWLRQ 5HSRUWV 6FL2PDJR 5HSRUW $FFHVV -RXUQDO '2$- $IULFDQ -RXUQDO 2QOLQH %LRRQOLQH ,QWHUQDWLRQDO 3KDUPDFHXWLFDO $EVWUDFWV

,1752'8&7,21

et al
in vitro

6WDWLVWLFDO DQDO\VLV

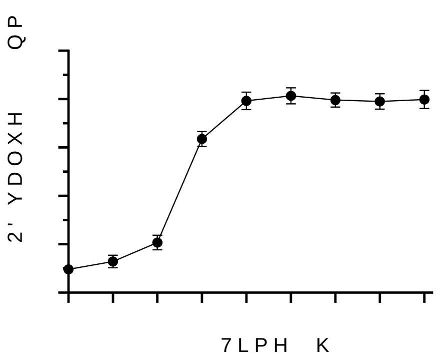
in vitro

p

5(68/76

%DFWHULDO JURZWK FXUYH

Ct,



)LJXUH

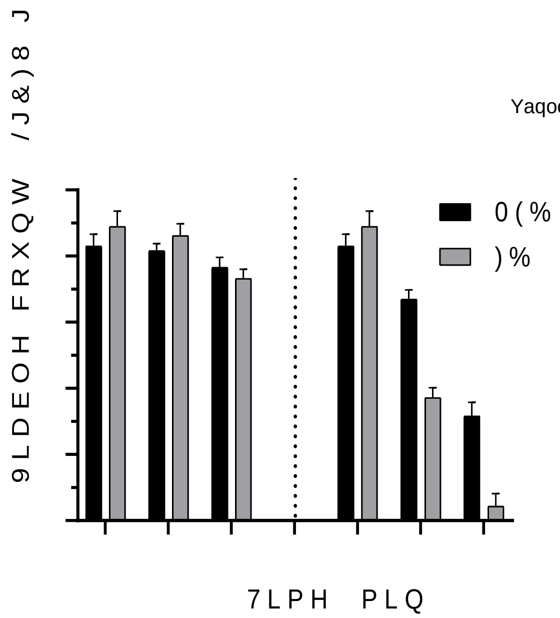
2SWLPL]HG PLFURHQFDSVXODWLRQ SURFHVV

7DEOH Ct

1R	)DFWRUV			JHODWLQ (UDWH
	1D DOJLQDWH Z Y	0 VWDUFK Z Y	Ct JHODWLQ Y Y	&D&O

Note:

In vitro JDVWURLQWHVWLQDO VLPXODWLRQ



)LJXUH

%LOH VDOW WROHUDQFH

Lactobacillus acidophilus

Bifidobacteria Lactobacilli

Ct

Ct

Ct

Lactobacillus

casei Lactobacillus acidophilus

Ct

et al

Bifidobacteria Bifidobacterium bifidum
Lactobacillus acidophilus

et al

et al

Lactobacillus

Ct

& 2 1 & / 8 6 , 2 1

Ct

Ct

Ct

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Acknowledgement

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