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LIST OF ABBREVIATIONS

ALAB	Amylolytic lactic acid bacteria
CCD	Central composite design
CEE	Crude extracellular enzyme
CIE	Crude intracellular enzyme
EC	Enzyme commission number
EDTA	Ethylenediaminetetraacetic acid
G1	Glucose
G2	Maltose
G3	Maltotriose
G4	Maltotetraose
G5	Maltopentaose
G6	Maltohexaose
G7	Maltoheptaose
GH	Glycoside hydrolase
Glu	Glutamic acid
GusA	β-glucoronidase enzyme
HPLC	High performance liquid chromatography

LIST OF ABBREVIATIONS (CONTINUED)

IP	Induction peptide
IPTG	Isopropyl β-D-1-thioglactopyranoside
IR	Intermediary region
IUBMB	International Union of Biochemistry and Molecular Biology
LAB	Lactic acid bacteria
LC-ESI-MS/MS	Liquid chromatography electrospray ionization tandem mass spectrometry
PAGE	Polyacrylamide gel electrophoresis
RU	Repeat unit
SBD	Starch binding domain
SLSF	Simultaneous liquefaction, saccharification and fermentation
SSF	Simultaneous saccharification and fermentation
Thr	Threonine
TLC	Thin layer chromatography
TSF	Two steps fermentation
RS	Rice starch
SE	Starchy effluent

LIST OF SYMBOLS

α	Alpha
β	Beta
Δ	Delta
μ	Specific growth rate
kDa	Kilodalton
P	Product concentration
S	Substrate concentration
t	Time
Q_p	Specific rate of product formation
Q_s	Specific substrate uptake rate
X	Dried cell weight
$Y_{p/s}$	Product yield
$Y_{x/s}$	Biomass

STATEMENT OF ORIGINALITY

1. An amylolytic lactic acid bacterium, *Lactobacillus plantarum* S21 is a rare strain of lactic acid bacteria capable of producing extracellular amylase and produce high concentration of lactic acid from starch. This thesis presented potential of the bacterium and proposed action mechanism for starch degradation

2. In order to express amylase gene from *L. plantarum* S21 in form of extracellular enzyme in other *Lactobacillus* sp., gene cloning in pSIP vector has been performed for investigation of feasibility to construct *Lactobacillus* sp. with amylase activity which rarely occur in nature. Moreover, signal peptide sequence from *L. plantarum* S21 has significant impact to regulate *L. plantarum* WCFS1 and *L. plantarum* TGL02 to produce extracellular enzyme. Therefore, this method could be an option to construct *Lactobacillus* sp. with other extracellular enzymes.