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Glycolysis and Ethanol Fermentation							
Name	Volume	EC No.	Substrate	Reaction	Reaction pH	Thermostability	Example of use
Product code			Reaction product		Reaction temperature		
Glucokinase YK1	1 ml	2.7.1.2	glucose	phosphorylation	7.5~11.0	Stable after incubation at 80 °C for 60 min	Using for diagnostic reagents and/or gluconeogenesis
GLK-97-01 *Ethanol Production Kit			glucose-6-phosphate		~80°C		
Glucosephosphate isomerase YK1	0.1 ml	5.3.1.9	glucose-6-phosphate	isomerization	6.0~9.0	—	Using for diagnostic reagents and/or gluconeogenesis
GPI-97-01 *Ethanol Production Kit			fructose-6-phosphate		—		
Phosphofructokinase YK1	0.25 ml	2.7.1.11	fructose-6-phosphate	phosphorylation	9.0~11.0	Stable after incubation at 60 °C for 60 min	Using for diagnostic reagents
PFK-97-01 *Ethanol Production Kit			fructose-1,6-bisphosphate		~60°C		
Fructose-1,6-bisphosphatase	—	3.1.3.11	fructose-1,6-bisphosphate	hydrolysis	7.0	—	Using for activity measurement of glycolytic enzyme and/or gluconeogenesis
FBP-97-01			fructose-6-phosphate		~65°C		
Fructose-1,6-bisphosphate aldolase HI1	2 ml	4.1.2.13	fructose-1,6-bisphosphate	aldol cleavage reaction	5.0~8.0	Stable after incubation at 100 °C for 60 min	Using for activity measurement of glycolytic enzyme and/or gluconeogenesis
FBA-07-01 *Ethanol Production Kit			dihydroxyacetone phosphate + glyceraldehyde-3-phosphate		~100°C		
Triosephosphate isomerase YK1	0.25 ml	5.3.1.1	dihydroxyacetone phosphate	isomerization	5.0~8.0	Stable after incubation at 95 °C for 60 min	Using for activity measurement of glycolytic enzyme and/or gluconeogenesis
TPI-97-01 *Ethanol Production Kit			glyceraldehyde-3-phosphate		~95°C		
Glyceraldehyde-3-phosphate dehydrogenase YK1	0.5 ml	1.2.1.12	glyceraldehyde-3-phosphate	oxidation and reduction (NAD <sup>+</sup> )	8.0~11.0	Stable after incubation at 70 °C for 60 min	Using for activity measurement of glycolytic enzyme and/or gluconeogenesis
GAP-97-01 *Ethanol Production Kit			1,3-bisphosphoglycerate		~70°C		
Phosphoglycerate kinase YK1	0.1 ml	2.7.2.3	1,3-bisphosphoglycerate	phosphorylation	8.0~11.0	Stable after incubation at 85 °C for 60 min	Using for activity measurement of glycolytic enzyme and/or gluconeogenesis
PGK-97-01 *Ethanol Production Kit			3-phosphoglycerate		~85°C		
Phosphoglycerate mutase HI1	0.1 ml	5.4.2.1	3-phosphoglycerate	isomerization	6.0~9.5	Stable after incubation at 75 °C for 60 min	Using for activity measurement of glycolytic enzyme and/or gluconeogenesis
PGM-35-01 *Ethanol Production Kit			2-phosphoglycerate		~75°C		
Enolase YK1	0.25ml	4.2.1.11	2-phosphoglycerate	dehydration reaction	5.5~7.5	Stable after incubation at 80 °C for 60 min	Using for activity measurement of glycolytic enzyme and/or gluconeogenesis
ENL-97-01 *Ethanol Production Kit			phosphoenolpyruvic acid		~80°C		
Pyruvate kinase HI1	1 ml	2.7.1.40	phosphoenolpyruvic acid	phosphorylation	5.0~8.0	Stable after incubation at 75 °C for 60 min	Using for diagnostic reagents and/or gluconeogenesis
PYK-75-01			pyruvic acid		~75°C		
Pyruvate kinase KS1	1 ml	2.7.1.40	phosphoenolpyruvic acid	phosphorylation	5.0~8.0	Stable after incubation at 85 °C for 60 min	Using for diagnostic reagents and/or gluconeogenesis
PYK-88-01 *Ethanol Production Kit			pyruvic acid		~85°C		
Pyruvate decarboxylase YK1	0.2 ml	4.1.1.1	pyruvic acid	decarboxylation (TPP)	5.0~7.5	Stable after incubation at 50 °C for 60 min	Using for activity measurement of glycolytic enzyme
PDC-22-01 *Ethanol Production Kit			acetaldehyde		~50°C		

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Glycolysis and Ethanol Fermentation							
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Product code			Reaction product		Reaction temperature		
Alcohol dehydrogenase YK1	1 ml	1.1.1.2	enanthaldehyde (aldehyde)	oxidation and reduction (NADPH)	4.5~7.0	Stable after incubation at 85 °C for 60 min	Using for reduction of long chain aldehyde
ADH-27-01			1-heptanol (alcohol)		~85°C		
Alcohol dehydrogenase HI1	1 ml	1.1.1.1	propionaldehyde (aldehyde)	oxidation and reduction (NADH)	4.5~7.0	Stable after incubation at 65 °C for 60 min	Using for asymmetric reduction of ketone and/or coenzyme regenerating system
ADH-73-01 *Ethanol Production Kit			1-propanol (alcohol)		~65°C		
Alcohol dehydrogenase HI2	1 ml	1.1.1.1	butyraldehyde (aldehyde)	oxidation and reduction (NADH)	4.5~6.5	—	Using for asymmetric reduction of ketone and/or coenzyme regenerating system
ADH-73-02			1-butanol (alcohol)		~65°C		
Lactate dehydrogenase 2	1.5 ml	1.1.1.27	pyruvic acid	oxidation and reduction	6.0~8.5	Stable after incubation at 70 °C for 60 min	Using for diagnostic reagents
LDH-97-01			Lactic acid		~70°C		
Secondary alcohol dehydrogenase A	1 ml	1.1.1.1	1,2-propanediol (secondary alcohol)	oxidation and reduction	8.5~10.5	Stable after incubation at 70 °C for 60 min	Using for oxidation of secondary alcohols
SAD-75-01			hydroxyacetone (ketone)		~70°C		
Secondary alcohol dehydrogenase B	5 ml	1.1.1.1	1,2-propanediol (secondary alcohol)	oxidation and reduction	8.0~10.0	Stable after incubation at 85 °C for 60 min	Using for oxidation of secondary alcohols
SAD-75-02			hydroxyacetone (ketone)		~85°C		

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Pentose Phosphate Pathway							
Name	Volume	EC No.	Substrate	Reaction	Reaction pH	Thermostability	Example of use
Product code			Reaction product		Reaction temperature		
Deoxyribose-phosphate aldolase	-	4.1.2.4	2-deoxy-D-ribose 5-phosphate	Condensation reaction	5.0~11.0	-	Using for synthesis of NADPH, or organic compounds
TRA-57-01			D-glyceraldehyde-3-phosphate + acetaldehyde		~50°C		
Glucose 1-dehydrogenase	1 ml	1.1.1.47	glucose	oxidation and reduction (NADP <sup>+</sup> )	5.0~8.0	Stable after incubation at 70 °C for 60 min	Using for glucose measurement or enzyme electrodes
GCD-41-01			gluconolactone		~70°C		
Glucose-6-phosphate dehydrogenase	1 ml	1.1.1.49	glucose-6-phosphate	oxidation and reduction (NADP <sup>+</sup> & NAD <sup>+</sup> )	6.5~8.0	Stable after incubation at 70 °C for 60 min	Using for diagnostic reagents
GLD-75-01			6-phosphogluconate		~70°C		
6-Phosphogluconate dehydrogenase	1 ml	1.1.1.44	6-phosphogluconate	oxidation and reduction (NADP <sup>+</sup> ) & decarboxylation	6.0~9.0	Stable after incubation at 70 °C for 60 min	Using for diagnostic reagents
PGD-75-01			ribulose 5-phosphate + CO <sub>2</sub>		~70°C		
Ribose-5-phosphate isomerase	0.5 ml	5.3.1.6	ribose 5-phosphate	isomerization	4.5~8.0	-	Using for synthesis of NADPH
PRI-07-01			ribulose 5-phosphate		~85°C		
Ribulose-5-phosphate epimerase	1 ml	5.1.3.1	ribulose 5-phosphate	optical isomerization	7.0~10.0	-	Using for synthesis of NADPH
RPE-97-01			xylulose 5-phosphate		~50°C		
Transketolase	-	2.2.1.1	(Substrate 1) erythrose 4-phosphate + xylulose 5-phosphate	transferring ketole group	7.0~9.0	-	Using for synthesis of NADPH
			(Product 1) fructose-6-phosphate + glyceraldehyde-3-phosphate				
			(Substrate 2) ribose 5-phosphate + xylulose 5-phosphate				
TRK-97-01			(Product 2) sedoheptulose 7-phosphate + glyceraldehyde-3-phosphate				
Xylose isomerase A (Glucose isomerase A)	10 ml	5.3.1.5	xylose	isomerization	6.0~8.0	-	Using for synthesis of xylulose
XYI-75-01			xylulose		~90°C		
Xylulokinase A	1 ml	2.7.1.17	xylulose	phosphorylation	7.0~9.0	-	Degradation of hemicellulosic biomass
XYK-35-01			xylulose 5-phosphate		~60°C		
Xylulokinase B	1 ml	2.7.1.17	xylulose	phosphorylation	7.0~9.0	-	Degradation of hemicellulosic biomass
XYK-54-01			xylulose 5-phosphate		~60°C		

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## Saccharification

Name	Volume	EC No.	Substrate	Reaction	Reaction pH	Thermostability	Example of use
Product code			Reaction product		Reaction temperature		
$\beta$ -1,3-Glucanase A	1 ml	3.2.1.39	$\beta$ -1,3-glucan	hydrolysis ( $\beta$ -1,3)	4.0~6.5	Stable after incubation at 85 °C for 60 min	Degradation of laminarin
TGL-74-01			$\beta$ -1,3-glucan oligomer		~85°C		
$\beta$ -1,3-Glucanase B	1 ml	3.2.1.39	$\beta$ -1,3-glucan	hydrolysis ( $\beta$ -1,3)	4.0~8.0	Stable after incubation at 90 °C for 60 min	Degradation of yeast $\beta$ -glucan
TGL-75-01			$\beta$ -1,3-glucan oligomer		~90°C		
$\beta$ -1,3-Glucanase C	1 ml	3.2.1.39	$\beta$ -1,3-glucan	hydrolysis ( $\beta$ -1,3)	4.5~7.5	Stable after incubation at 50 °C for 60 min	Degradation of laminarin
TGL-54-01			$\beta$ -1,3-glucan oligomer		~50°C		
Cellulase Cel.1	50 ml	3.2.1.4	$\beta$ -1,4-glucan (cellulose)	hydrolysis ( $\beta$ -1,4)	4.5~7.0	—	Degradation of cellulosic biomass
EGL-50-01			cellobiose		~90°C		
Cellulase Cel.5	2 ml	3.2.1.4	$\beta$ -1,4-glucan (cellulose)	hydrolysis ( $\beta$ -1,4)	4.5~7.0	—	Degradation of cellulosic biomass
EGL-50-02			cellobiose		~90°C		
Cellulase HT1	10 ml	3.2.1.4	$\beta$ -1,4-glucan (cellulose)	hydrolysis ( $\beta$ -1,4)	4.5~8.5	—	Degradation of cellulosic biomass
EGL-54-01			cellobiose		~75°C		
Cellulase HT2	10 ml	3.2.1.4	$\beta$ -1,4-glucan (cellulose)	hydrolysis ( $\beta$ -1,4)	5.0~7.0	—	Degradation of cellulosic biomass
EGL-54-02			cellobiose		~80°C		
Cellulase HT3	10 ml	3.2.1.4	$\beta$ -1,4-glucan (cellulose)	hydrolysis ( $\beta$ -1,4)	5.5~7.0	—	Degradation of cellulosic biomass
EGL-54-03			cellobiose		~75°C		
Cellulase HT4	10 ml	3.2.1.4	$\beta$ -1,4-glucan (cellulose)	hydrolysis ( $\beta$ -1,4)	4.0~6.0	—	Degradation of cellulosic biomass
EGL-54-04			cellobiose		~80°C		
Cellobiohydrolase HT1	10 ml	3.2.1.91	$\beta$ -1,4-glucan	hydrolysis ( $\beta$ -1,4)	5.0~7.0	—	Degradation of cellulosic biomass
CBH-54-01			cellobiose		~80°C		
$\beta$ -Glucosidase HT1	1 ml	3.2.1.74	$\beta$ -1,4-glucan	hydrolysis ( $\beta$ -1,4)	4.0~6.5	—	Degradation of cellulosic biomass
BGL-54-01			glucose		~65°C		
Xylanase YK1	10 ml	3.2.1.8	xylan	hydrolysis ( $\beta$ -1,4)	3.0~7.0	Stable after incubation at 50 °C for 60 min	Degradation of hemicellulosic biomass
XYL-54-01			xylo-oligosaccharides		~80°C		
$\beta$ -Xylosidase YK1	1 ml	3.2.1.37	xylo-oligosaccharides	hydrolysis ( $\beta$ -1,4)	4.0~8.0	Stable after incubation at 80 °C for 60 min	Degradation of hemicellulosic biomass
XYS-75-01			xylose		~100°C		
Chitinase	1 ml	3.2.1.14	chitin	hydrolysis	3.0~8.0	—	Degradation of $\alpha$ , $\beta$ -chitin
CTN-50-01			chitobiose		~85°C		
Pullulanase KS1 (solution and spray-dried products are available)	10 ml	3.2.1.41	pullulan	hydrolysis ( $\alpha$ -1,6)	4.5~7.0	—	Saccharification of pullulan and starch
PLN-97-01			maltotriose		~90°C		
Amylopullulanase	10 ml	3.2.1.135	pullulan or amylose	hydrolysis ( $\alpha$ -1,6 & $\alpha$ -1,4)	4.0~7.0	—	Saccharification of pullulan and starch
APN-97-01			malto-oligosaccharides		~90°C		

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Product code			Reaction product		Reaction temperature		
β-1,4-Mannanase TT1	10 ml	3.2.1.78	mannan	hydrolysis	4.5~7.0	Stable after incubation at 90 °C for 60 min	Dissolving glucomannan and galactomannan
MNN-75-01			manno-origosaccharides, mannose		~100°C		
Amyloglucosidase	10 ml	3.2.1.3	α-1,4-glucan	hydrolysis	4.0~5.0	Stable after incubation at 80 °C for 60 min	Saccharification of pullulan and starch
AGL-39-01			glucose		~80°C		

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Others							
Name	Volume	EC No.	Substrate	Reaction	Reaction pH	Thermostability	Example of use
Product code			Reaction product		Reaction temperature		
<i>Ape</i> DNA Ligase (with Reaction Buffer)	0.025 ml	6.5.1.1	ATP + (deoxyribonucleotide) n + (deoxyribonucleotide) m	Forming phosphoric ester bonds	—	Stable after incubation at 100 °C for 60 min	Using for diagnostic reagents
DLG-50-01			AMP + diphosphate + (deoxyribonucleotide) n+m		~100°C		
Glycerol dehydrogenase HII	0.5 ml	1.1.1.6	1,2-propanediol (or glycerol)	oxidation and reduction (NAD <sup>+</sup> )	7.0~10.0	Stable after incubation at 85 °C for 60 min	Using for measurement of neutral fat
GDH-75-01			hydroxyacetone (or dihydroxyacetone)		~100°C		
<i>myo</i> -Inositol-1-phosphate synthase	1 ml	5.5.1.4	glucose-6-phosphate	isomerization (NAD <sup>+</sup> )	7.5~9.5	—	Production of inositol
IPS-50-01			myo-inositol 1-phosphate		~95°C		
Malate dehydrogenase	1.7 ml	1.1.1.37	malic acid	oxidation and reduction (NAD <sup>+</sup> or NADP <sup>+</sup> )	9.0~12.0	Stable after incubation at 85 °C for 60 min	Using for diagnostic reagents and/or gluconeogenesis
MDH-27-01			oxaloacetic acid		~85°C		
Malate dehydrogenase (decarboxylating)	1 ml	1.1.1.38	malic acid or oxaloacetic acid	decarboxylation (NAD <sup>+</sup> )	7.0~10.5	Stable after incubation at 70 °C for 60 min	Using for diagnostic reagents and/or gluconeogenesis
MDH-73-01			pyruvic acid + CO <sub>2</sub>		~70°C		
Laccase YK1	2 ml	1.10.3.2	benzenediol	oxidation and reduction (CuSO <sub>4</sub> )	3.0~5.0	Stable after incubation at 85 °C for 60 min	Oxidation of phenol
LAC-27-01			benzosemiquinone		~95°C		
Expansin	2 ml, 10 ml	—	—	—	—	—	The additive which promotes cellulose degradation
EXP-63-01			—		—		
Acetate kinase	—	2.7.2.1	acetyl phosphate + ADP	phosphorylation	6.0~7.5	Stable after incubation at 80 °C for 60 min	Using for ATP regeneration system
ACK-75-01			acetate + ATP		~80°C		
Adenylate kinase	—	2.7.4.3	2ADP	phosphorylation	4.5~6.0	Stable after incubation at 90 °C for 60 min	Using for ATP regeneration system
ADK-75-01			ATP + AMP		~90°C		
Aldehyde dehydrogenase	—	1.2.1.3	aldehyde	oxidation and reduction (NAD <sup>+</sup> )	6.0~9.5	Stable after incubation at 55 °C for 60 min	Using for measurement of aldehyde
ALD-35-01			carboxylate		~55°C		
Alditol oxidase	—	1.1.3.41	sorbitol (or xylitol)	oxidation and reduction	5.5~9.5	Stable after incubation at 75 °C for 60 min	Using for measurement of sorbitol (xylitol)
ALO-35-01			glucose (or xylose)		~75°C		
Glycerol-3-phosphate dehydrogenase A	—	1.1.1.94	dihydroxyacetone phosphate	oxidation and reduction (NADPH)	6.5~9.0	Stable after incubation at 75 °C for 60 min	Using for reduction of dihydroxyacetone phosphate
GLP-35-01			glycerol-3-phosphate		~75°C		
Glycerol-3-phosphate dehydrogenase B	—	1.1.5.3	glycerol-3-phosphate	oxidation and reduction	6.0~9.5	Stable after incubation at 75 °C for 60 min	Using for oxidation of glycerol-3-phosphate
GLP-74-01			dihydroxyacetone phosphate		~70°C		
KDG aldolase	—	4.1.2.20	pyruvate + aldehyde	aldol reaction	4.0~7.0	Stable after incubation at 85 °C for 60 min	Using for synthesis of chemical products
KAL-73-01			aldol product		~85°C		

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Product code			Reaction product		Reaction temperature		
Nitrite reductase	—	1.7.2.1	nitrite	oxidation and reduction	6.0~7.0	Stable after incubation at 80 °C for 60 min	Using for nitrite removal
NRN-68-01			nitric oxide		~80°C		
Polyphosphate kinase	—	2.7.4.1	polyphosphate (n) + ADP	phosphorylation	4.5~5.5	Stable after incubation at 80 °C for 60 min	Using for ATP regeneration system
PPK-68-01			polyphosphate (n-1) + ATP		~80°C		
Urate oxidase	—	1.7.3.3	urate	oxidation and reduction	6.5~10.5	Stable after incubation at 55 °C for 60 min	Using for measurement of uric acid
URI-11-01			5-Hydroxyisourate		~55°C		
Bilirubin oxidase	—	1.3.3.5	bilirubin + O <sub>2</sub>	oxidation and reduction	3.0~6.0	Stable after incubation at 60 °C for 30 min	Using for measurement of uric acid
BOX-65-01			biliverdin + H <sub>2</sub> O		~70°C		

Kit		
Name	Kit Contets	Summary
Enzymatic Ethanol Production Kit	Enzyme Mix (11 kinds of enzymes) 、 Alcohol dehydrogenase、 10×Reaction buffer、 Glucose solution	12 kinds of enzymes take part in conversion from glucose to ethanol. This kit is an experimental kit to enable conversion from glucose to ethanol by the continuous enzyme reaction with those 12 kinds of thermostable enzymes <i>in vitro</i> .
KETP01		