



Onion Waste Recycling to Produce the Value Added by-Products

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CHONNAM NATIONAL UNIVERSITY
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2010-2019 Priority Research Center



Biotechnology is key Competences of BRC

**High Value
Creation in
Biomass
Bioconversion**

1

**Development of Efficient
Pretreatment Methods**

2

**Biomass Bioconversion
by Enzymatic Process**

3

**Developing Advanced
Biotechnology System**





Onion waste is produced from various processed onions.

They are one of major industrial waste.

BRC Pioneering Following Issues



Environmental-Friendly Safe to handle **Wastes**



Cost reduction of Waste treatment



Design Agricultural Wastes Recycling



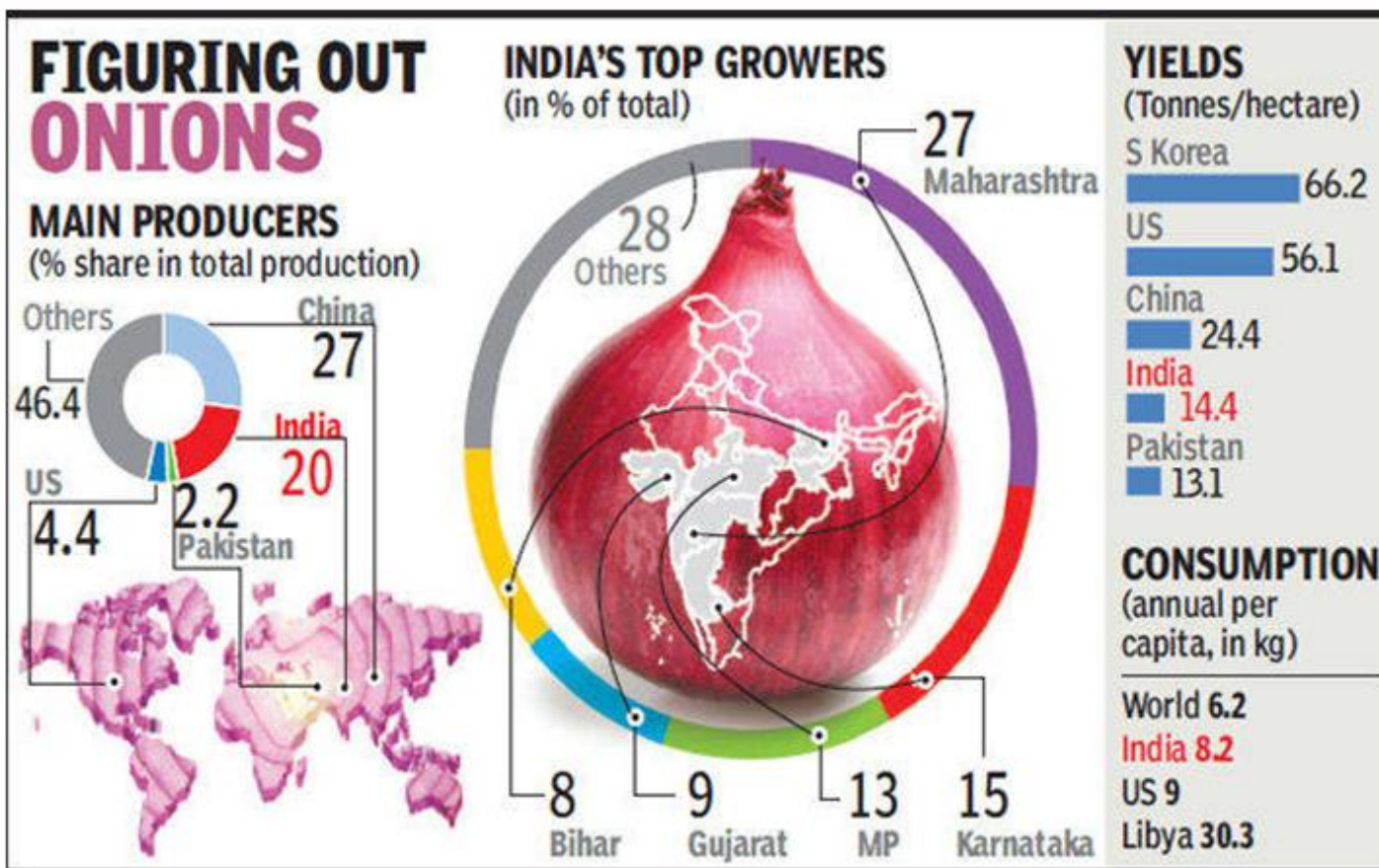
Value Added Material Production

World Onion Production

83 million tons of onions are produced annually (2013)

Country	Thousand Tons
World	82,852
China	22,600
India	16,309
United States	3,277
Iran	2,260
Russia	2,081
Egypt	2,025
Turkey	1,819
Korea, South	1,196
Spain	1,187
Algeria	1,183
Others	28,915

High yields are found in Korea, Japan, Europe and the USA.

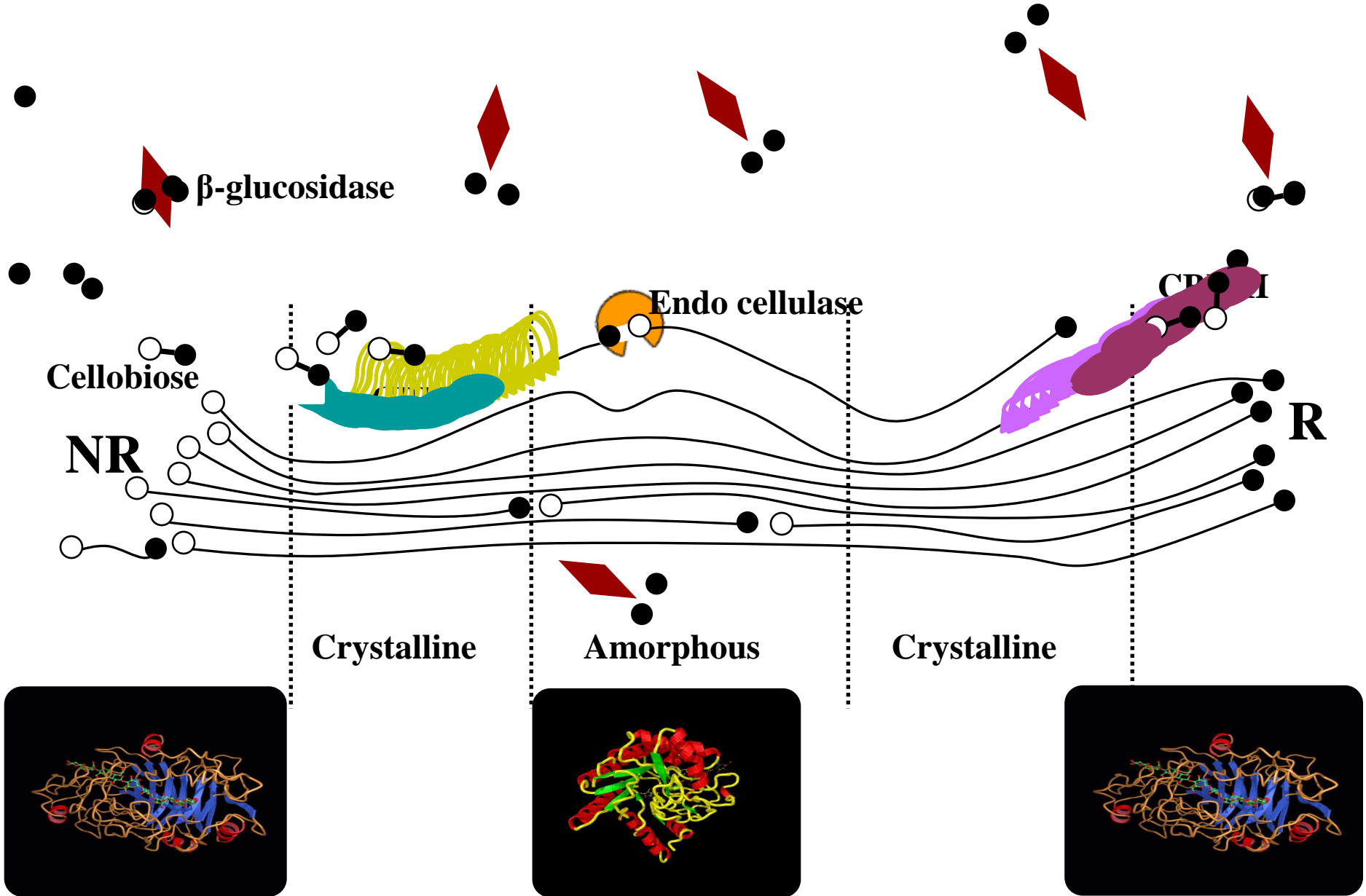


Onion Production (Dry) in South Korea

yr	ton
2009	1,372,291
2010	1,411,646
2011	1,520,016
2012	1,195,737
2013	1,294,009

Production Area	(ha)
Chonnam	12,080
Kyungnam	5,294
Kyungpook	2,602
Chobuk	1,654

Enzymatic bio-process- biodegradation of lignocellulose



Strategy for Enzyme Cost Reduction

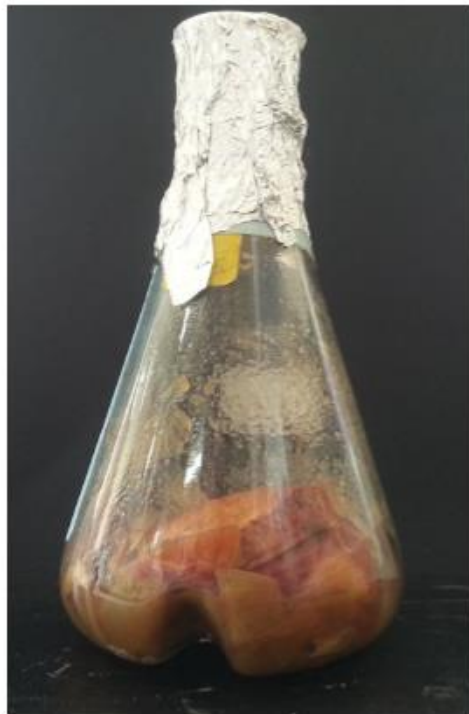


Increase
Enzyme
Activity



Low Cost
Mass Production

Produce of Onion Waste Hydrolysates by Enzymatic Bioprocess



12 h
→



Onion Skin Waste



Enzymatic hydrolysis



Onion sugars



Fermentation

Bioethanol

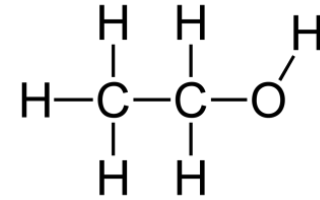
We evaluated the use of OSW for biosugar and Quercetin production



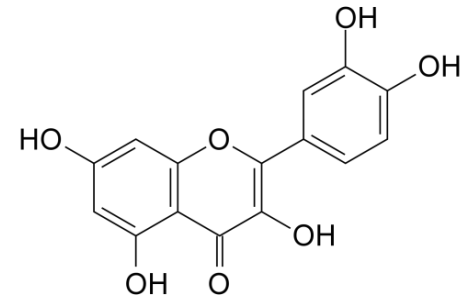
Onion production
82.9 million T/yr



Onion Skin Waste



Bio-ethanol



Quercetin

Value-added byproduct

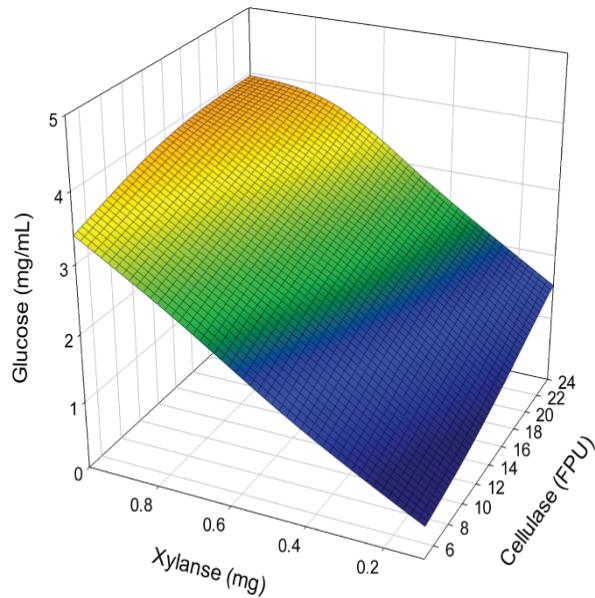
Chemical composition (% dry weight) of onion skin waste.

% (w/w)	Onion skin
Rhamnose	2.5
Arabinose	1.4
Xylose	4.2
Mannose	3.7
Galactose	2.8
Glucose	40.6
Total (sugar)	53.7
Quercetin	0.1- 0.2

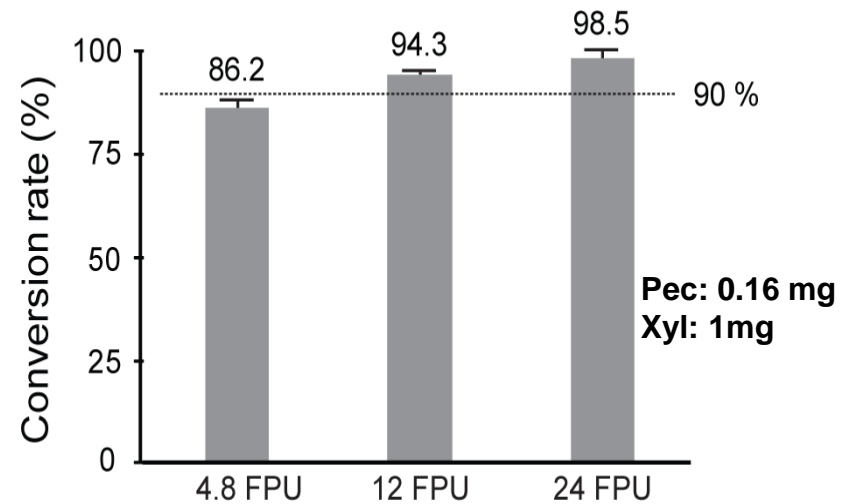
Glucose Concentration of OSW Hydrolysate under Different Enzyme Loading Conditions.

Cellulase (FPU/g OS)	Pectinase (mg/ g OS)	Xylanase (mg/g OS)	Glucose (mg/mL)	Conversion rate (%)
4.8	0.06	0.1	0.4	9.9
4.8	0.06	0.5	1.65	40.6
4.8	0.06	0.75	2.53	62.3
4.8	0.06	1.0	3.3	81.3
4.8	0.16	0.1	0.55	13.5
4.8	0.16	0.5	1.76	43.3
4.8	0.16	0.75	2.66	65.5
4.8	0.16	1.0	3.5	86.2
12	0.06	0.1	0.67	16.5
12	0.06	0.5	2.19	53.9
12	0.06	0.75	2.88	70.9
12	0.06	1.0	3.72	91.6
12	0.16	0.1	0.86	21.2
12	0.16	0.5	2.37	58.4
12	0.16	0.75	3.16	77.8
12	0.16	1.0	3.83	94.3
24	0.06	0.1	1.46	36.0
24	0.06	0.5	2.87	70.7
24	0.06	0.75	3.63	89.4
24	0.06	1.0	3.92	96.6
24	0.16	0.1	1.60	39.4
24	0.16	0.5	2.94	72.4
24	0.16	0.75	3.85	94.8
24	0.16	1.0	4.01	98.5

Optimized enzyme loading volume – 90% bioconversion rate

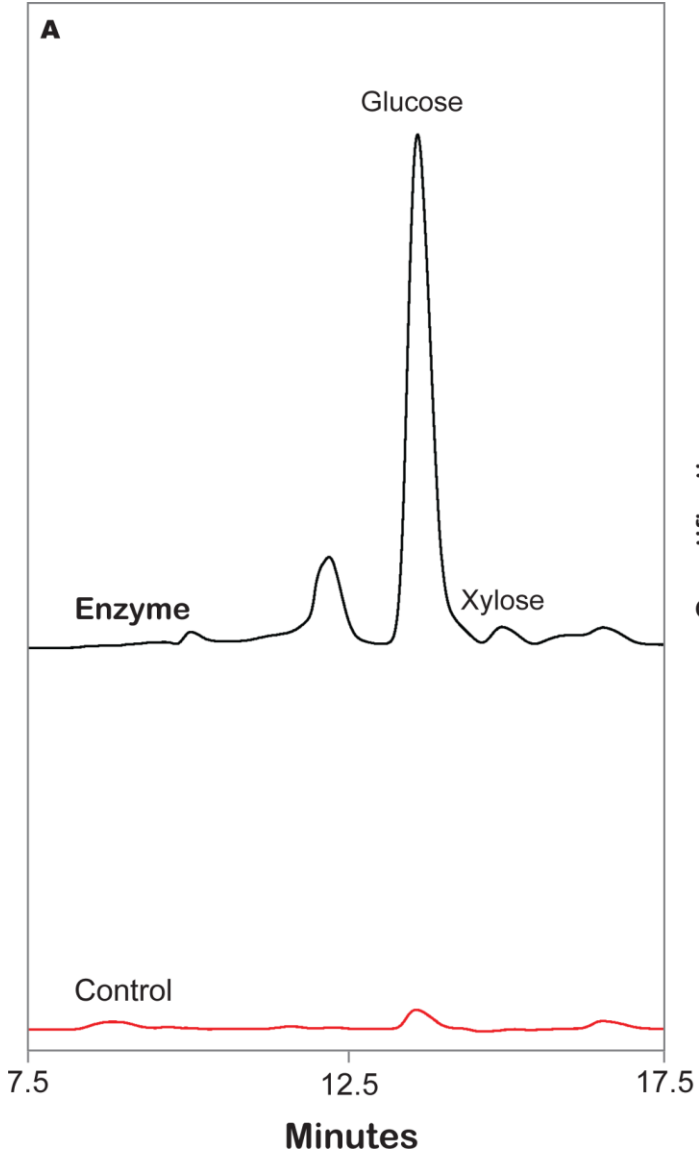


Effect of enzyme loading on hydrolysis

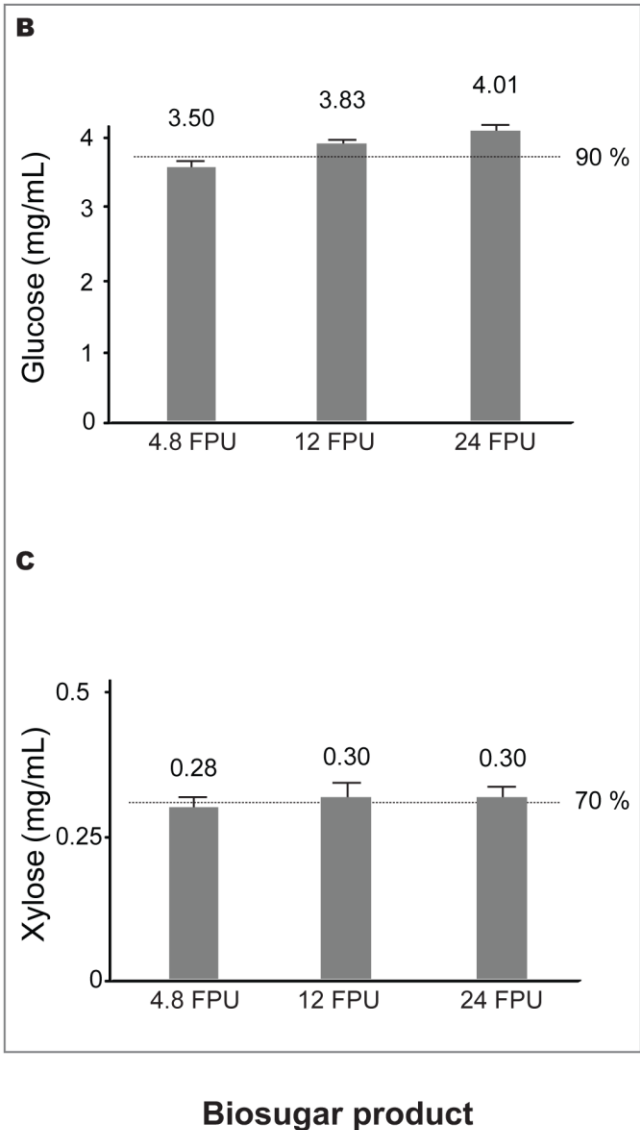


OSW to Biosugar conversion rate

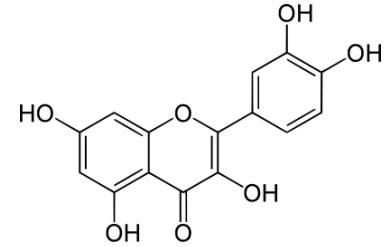
Sugar Analysis after Enzymatic Hydrolysis



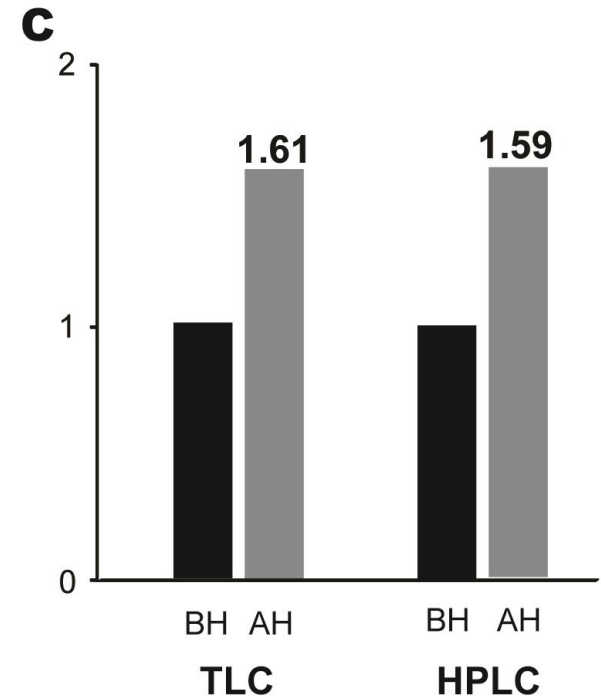
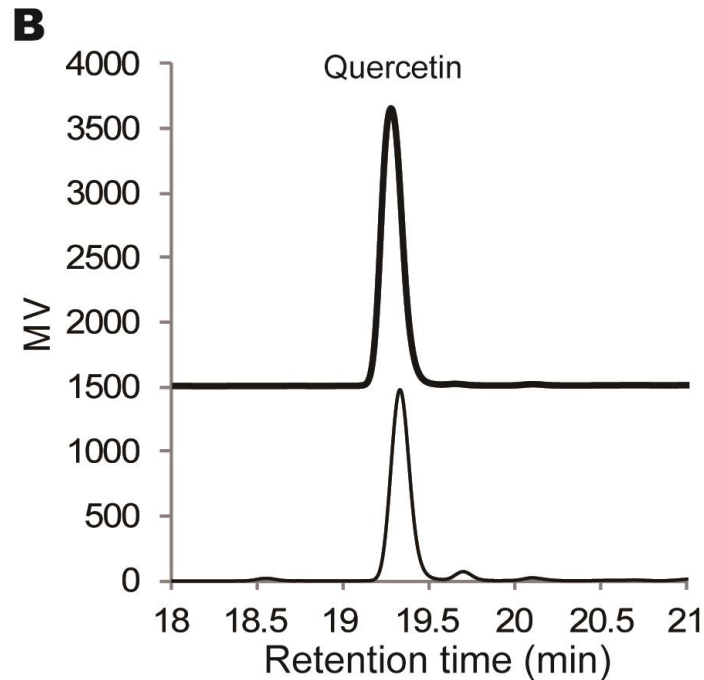
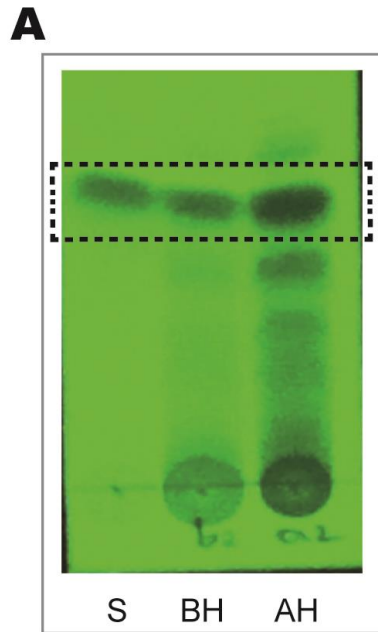
Quantification →



Thin-layer chromatography (TLC) plates showing the presence of quercetin in isolated onion skin wastes (OSWs) samples before and after enzymatic hydrolysis.

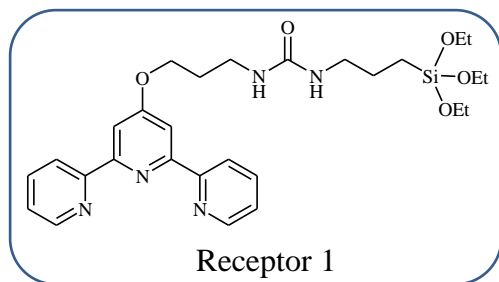
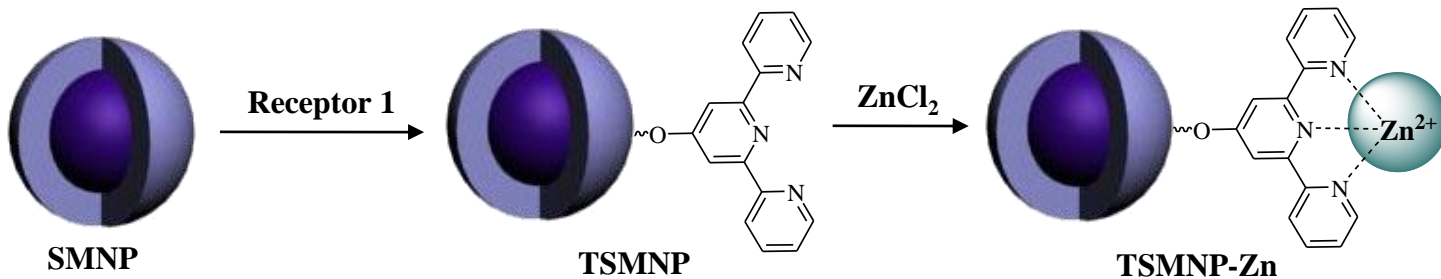


약 1.6 배 증가

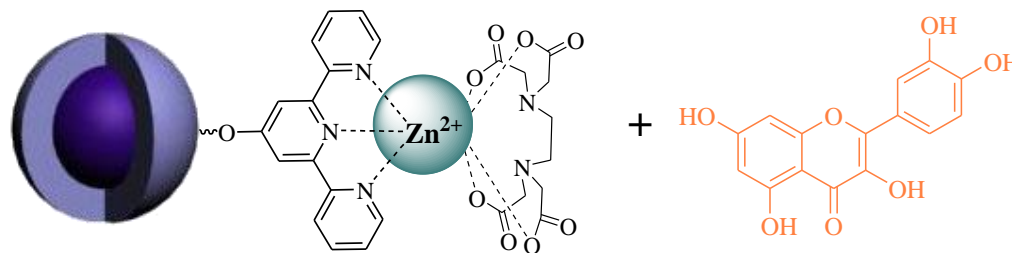
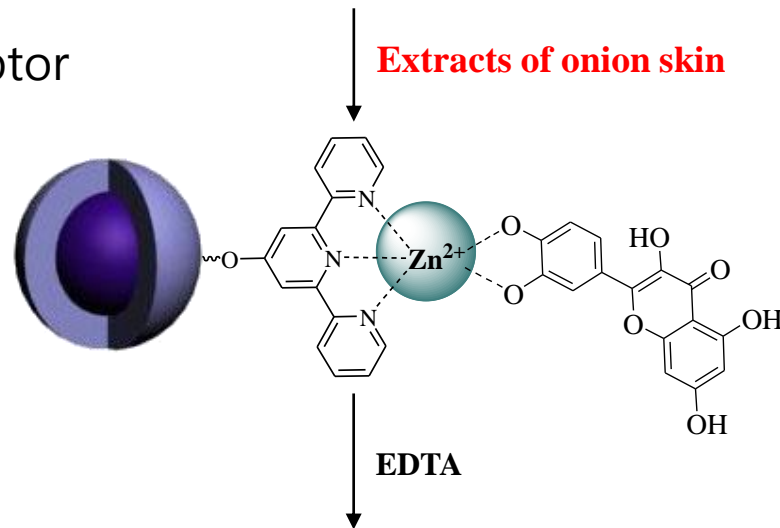


Biomagnetic Separation Techniques

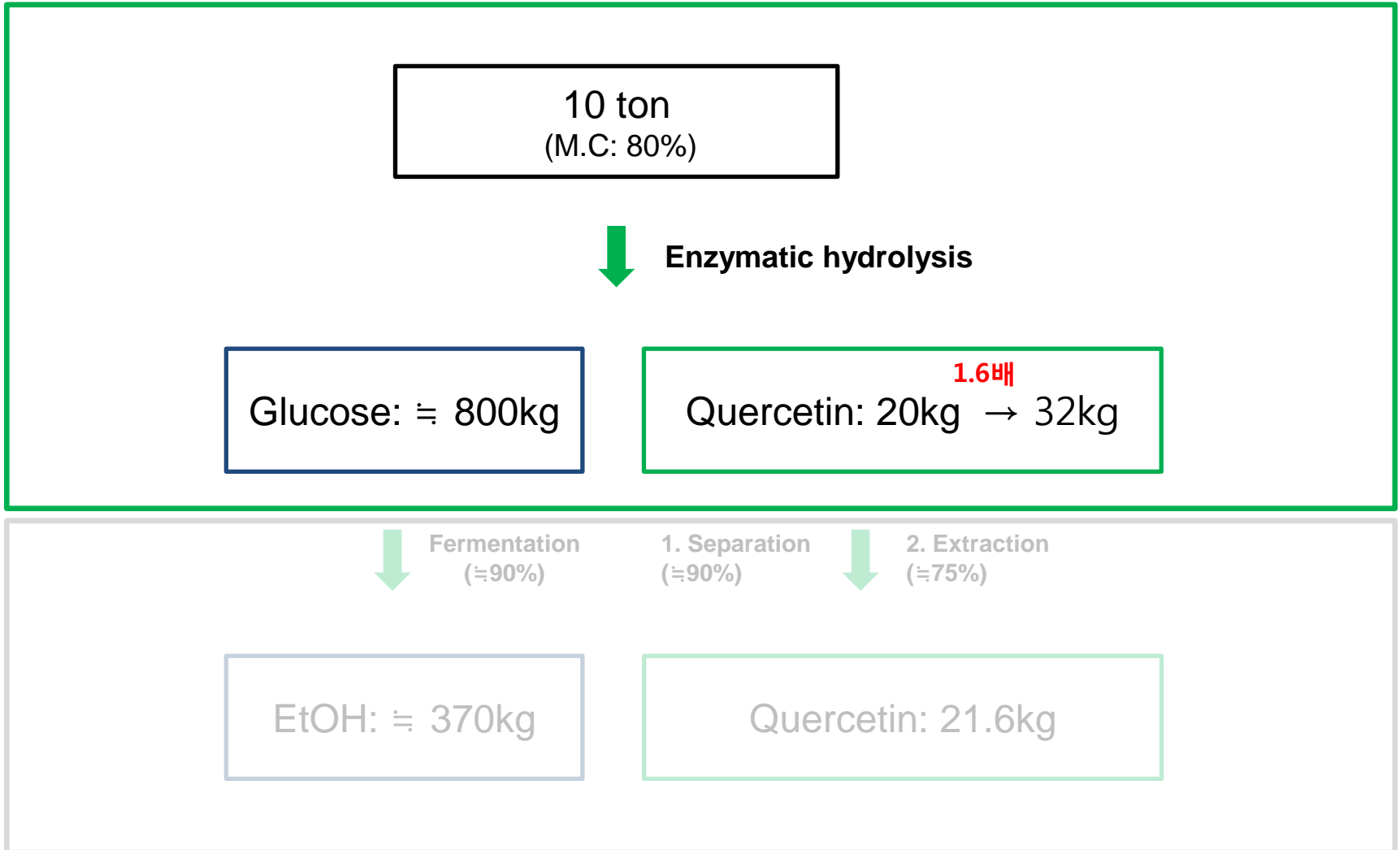
Silica coated magnetic nanoparticle



Terpyridine receptor



Mass balance – Bioethanol and quercetin production



Thank you for your attention.



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QUESTIONS?
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