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## 1. Introduction

### Application of $\beta$ -glucan

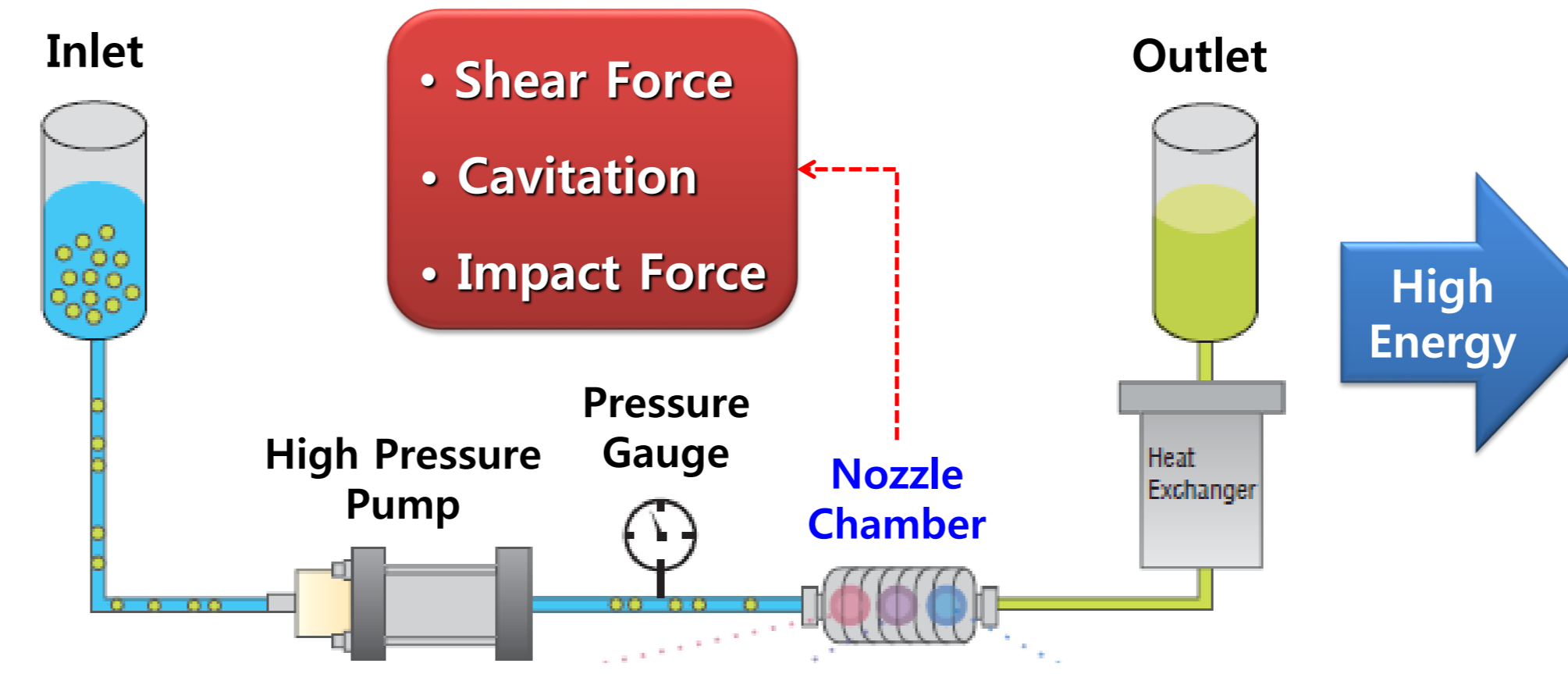


**Problems**  
High Viscosity & Large Molecular Weight

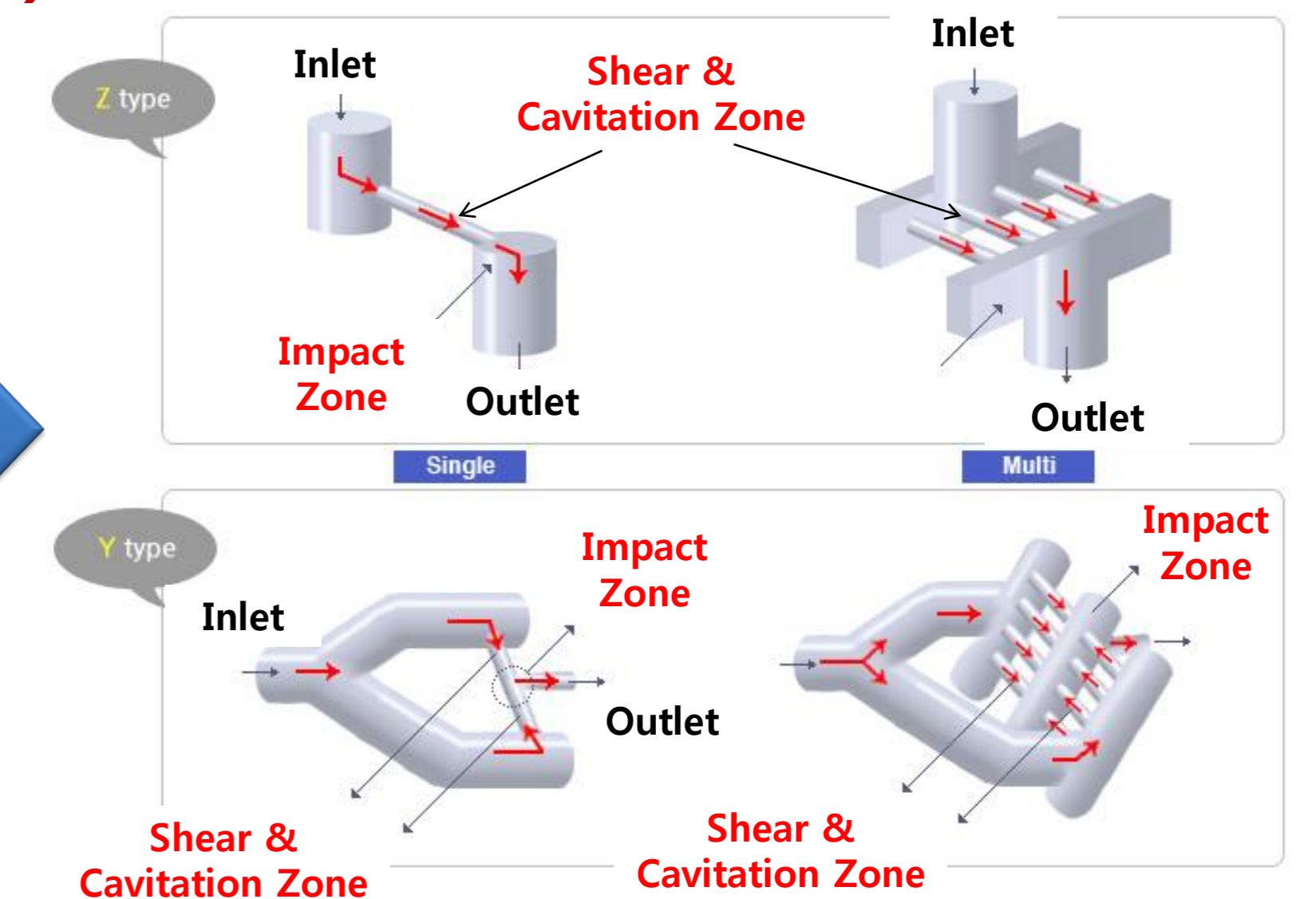
### Method of Depolymerization

Process	Method	Advantage	Disadvantage
Physical (Radiation)	Ultrasonic	• No Waste (Acid/Alkali), No-residues	• Long Time Process • Process Noise
	E-beam, $\gamma$ -Ray	• No Waste (Acid/Alkali), No-residues	• Dangerous Process • High Cost
Chemical	Acidic hydrolysis	• High Solubility • High Efficiency of Depolymerization	• Acid waste water • Complex Process
	Phosphorylation Sulfation	• Enhancement of Solubility and Functionality	• Low Efficiency
Biological	Enzymatic hydrolysis	• Selective Decomposition • High Efficiency of Depolymerization	• High Cost • Inefficiency

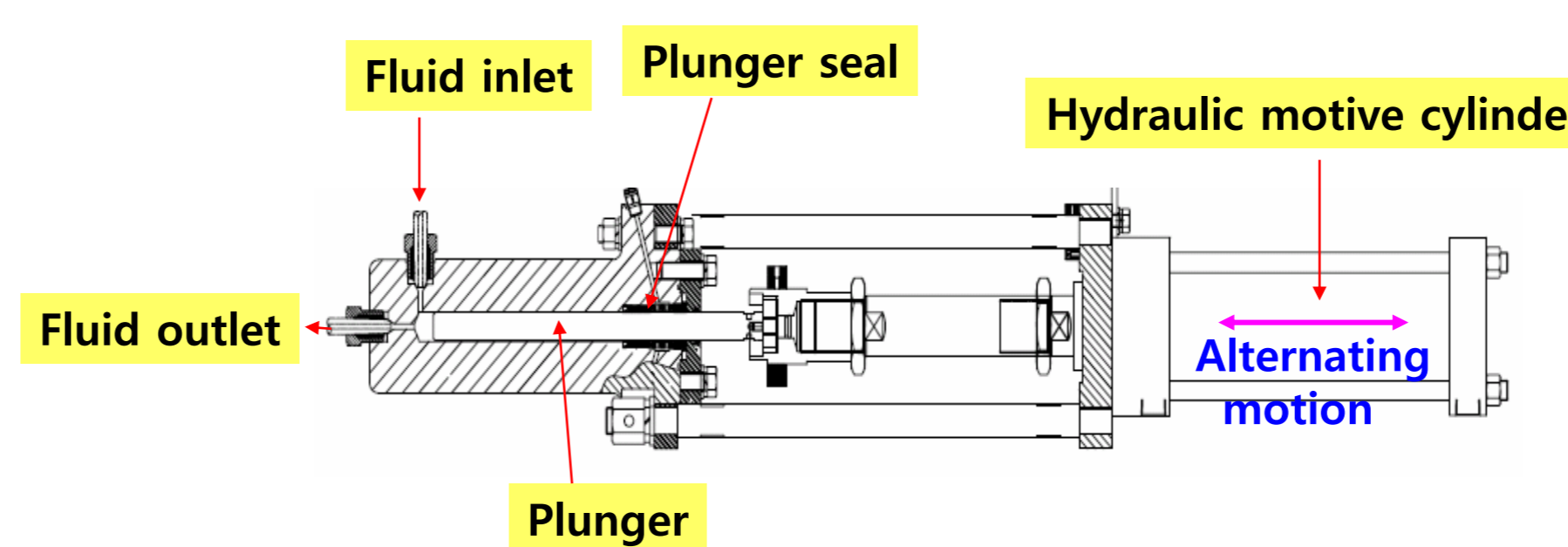
### High Pressure Homogenizer (HPH, Nano Disperser, ILSHIN AUTOCLAVE)



#### Nozzle Chamber



#### High pressure Intensifier



#### Fluid Velocity (Sound Speed: 340 m/s)

Pressure (bar)	500	1000	1500	2000	2500
Fluid velocity (m/sec)	313	442	542	626	700

## 2. Experimental

### Experimental

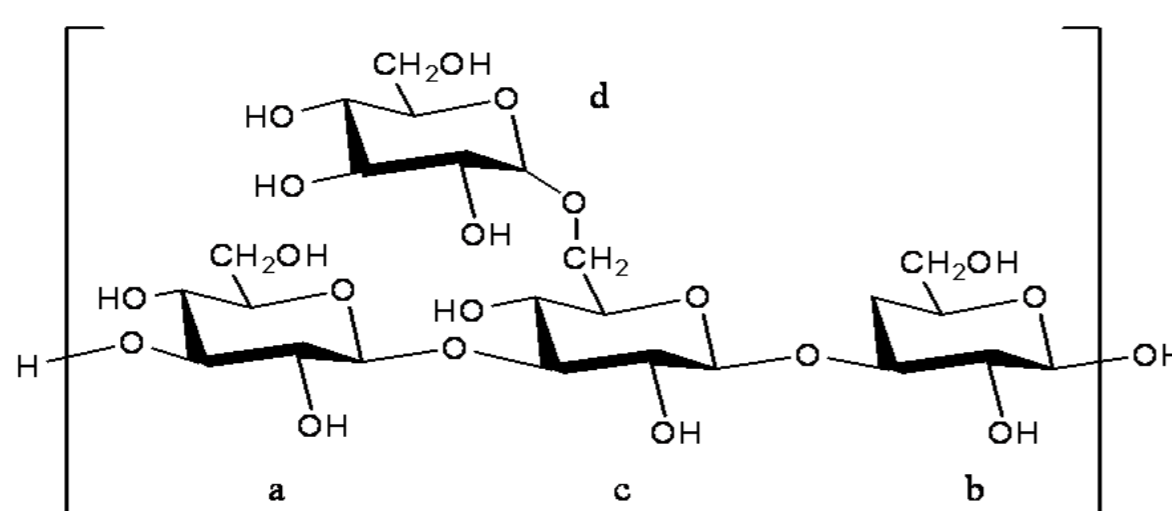
- Natural Polymer:  $\beta$ -glucan
- Solvent: D.I Water
- Nano Disperser: NLM 100

Operating Pressure (bar)	200 – 1500
Max. Flow Rate (ml/min)	100
Pump System	Motor Driven
Dimension (mm)	300*450*300
Weight (kg)	30

### Characterization

- Viscometer
- Gel Chromatograph
- FT-IR
- UV-Vis
- XRD

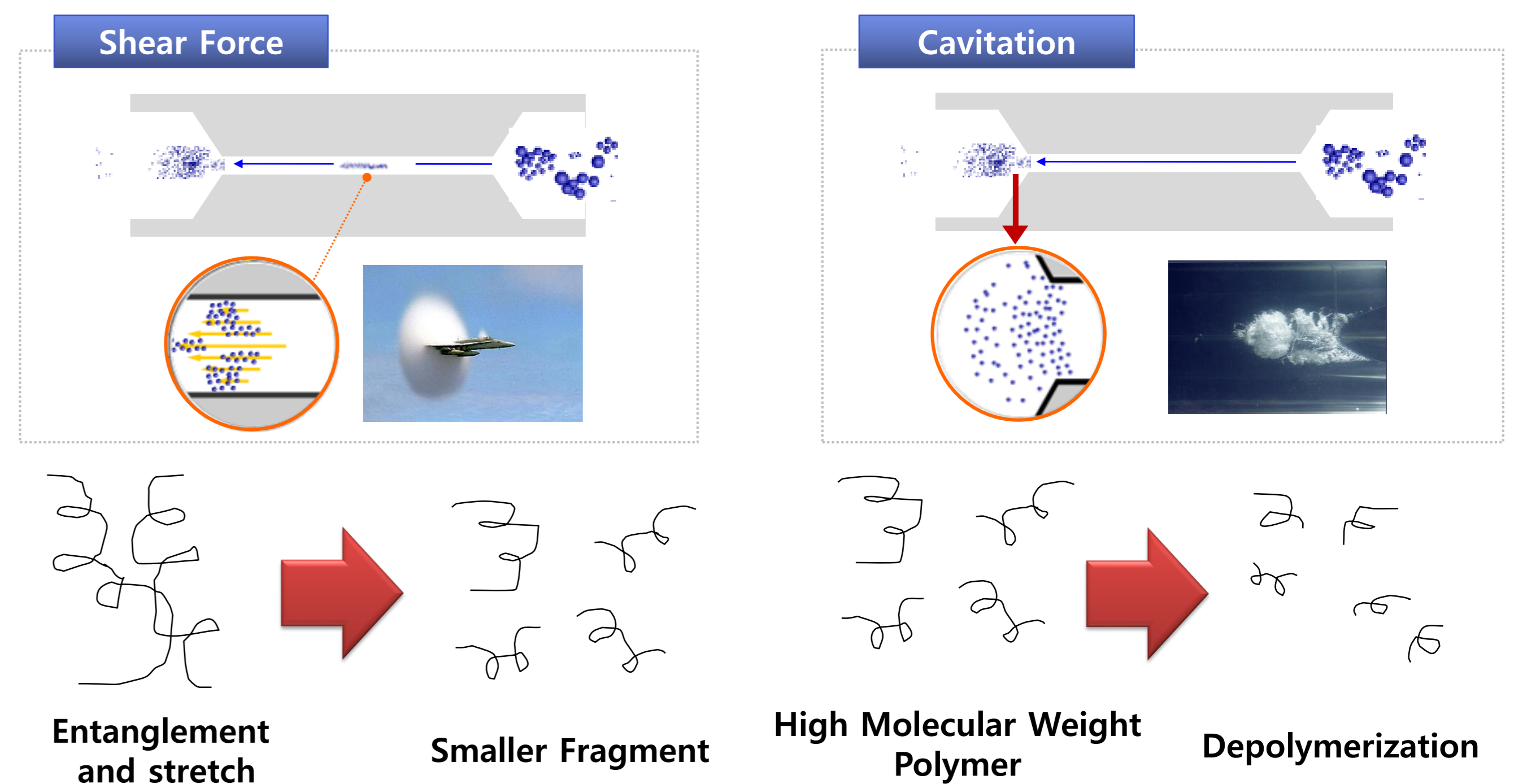
#### $\beta$ -glucan structure



Large Molecular Weight  
5 % (w/v)  $\beta$ -glucan Solution

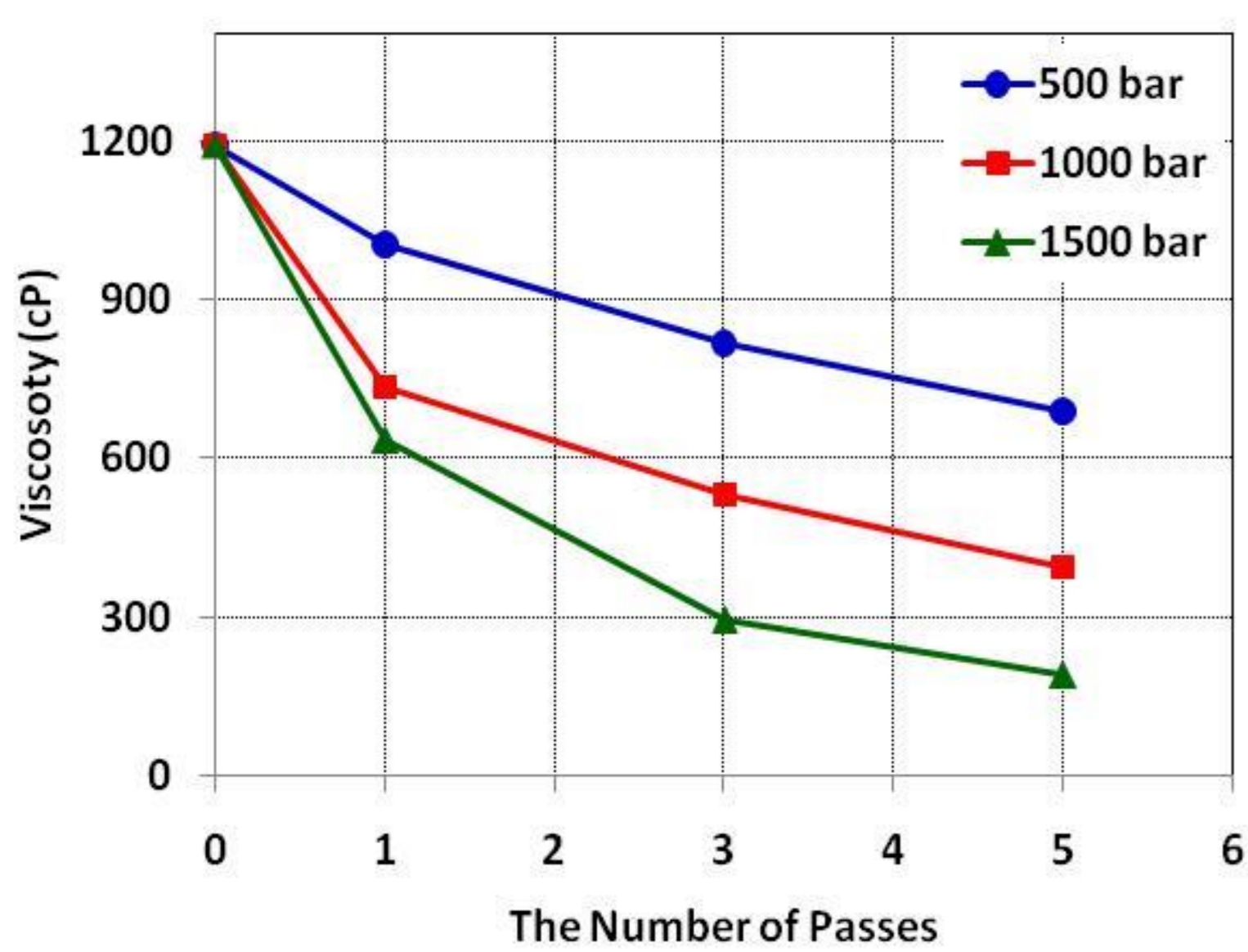


Low Molecular Weight  
5 % (w/v)  $\beta$ -glucan Solution

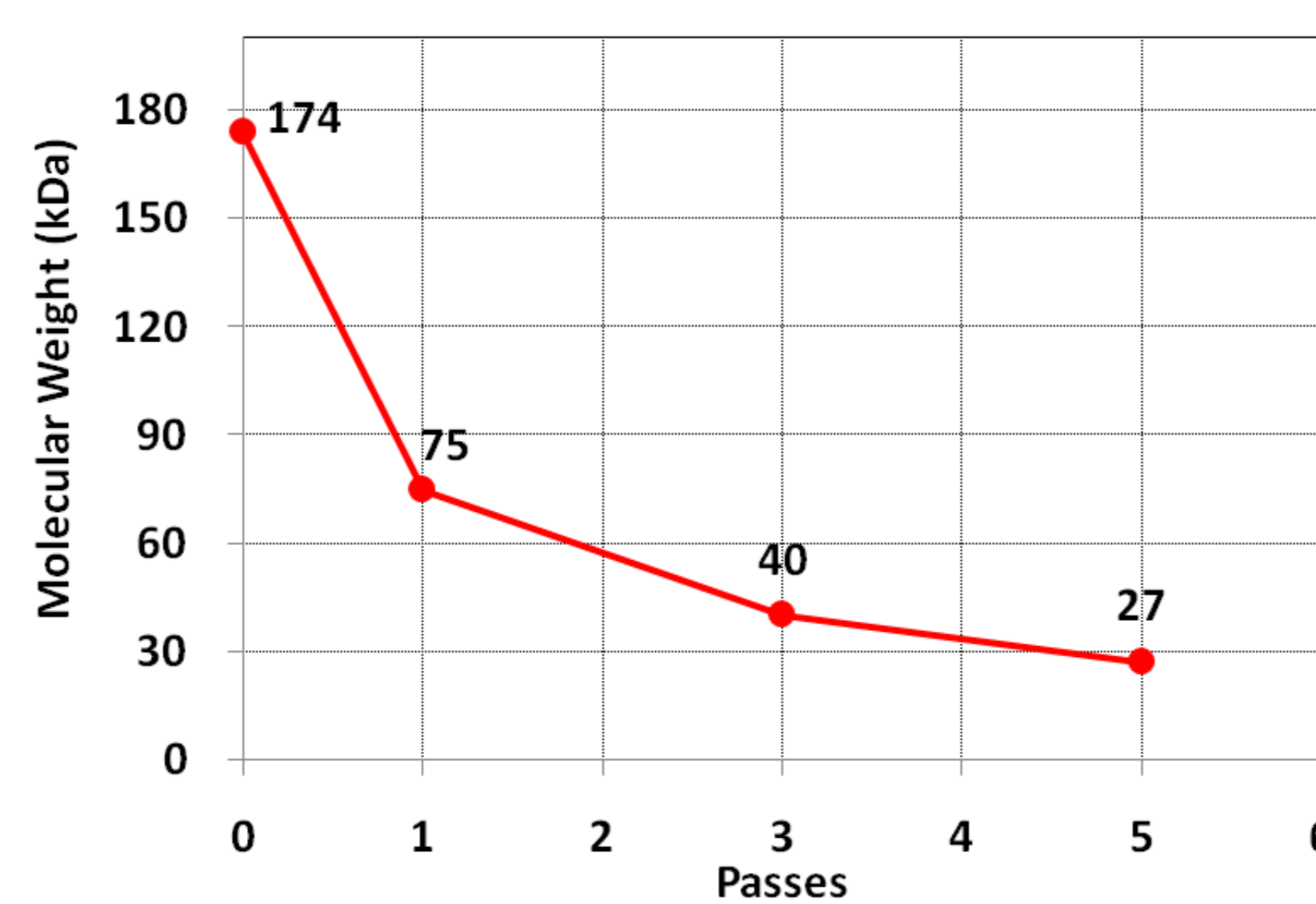


## 3. Results & Discussion

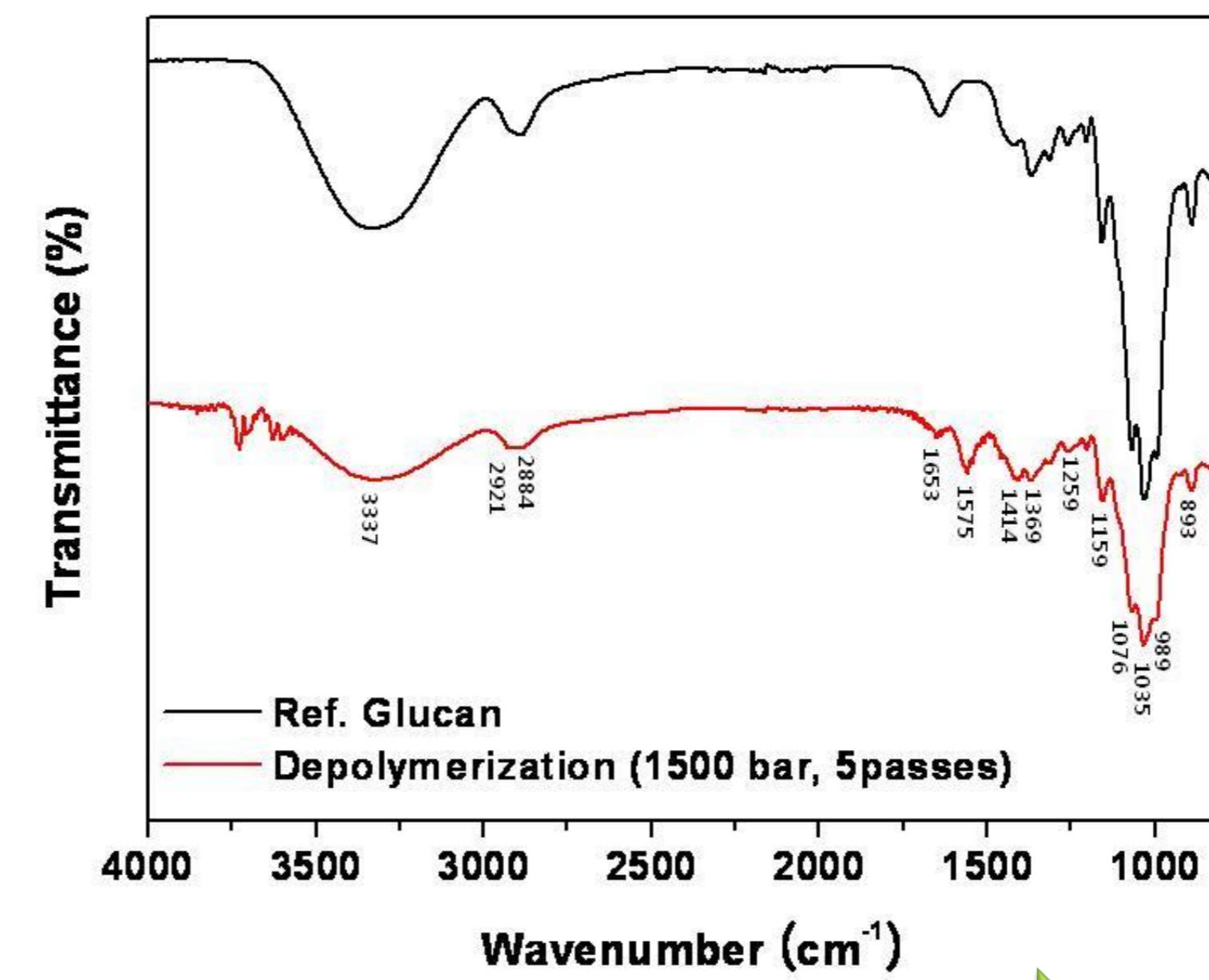
### Viscosity(5 % (w/v) $\beta$ -glucan)



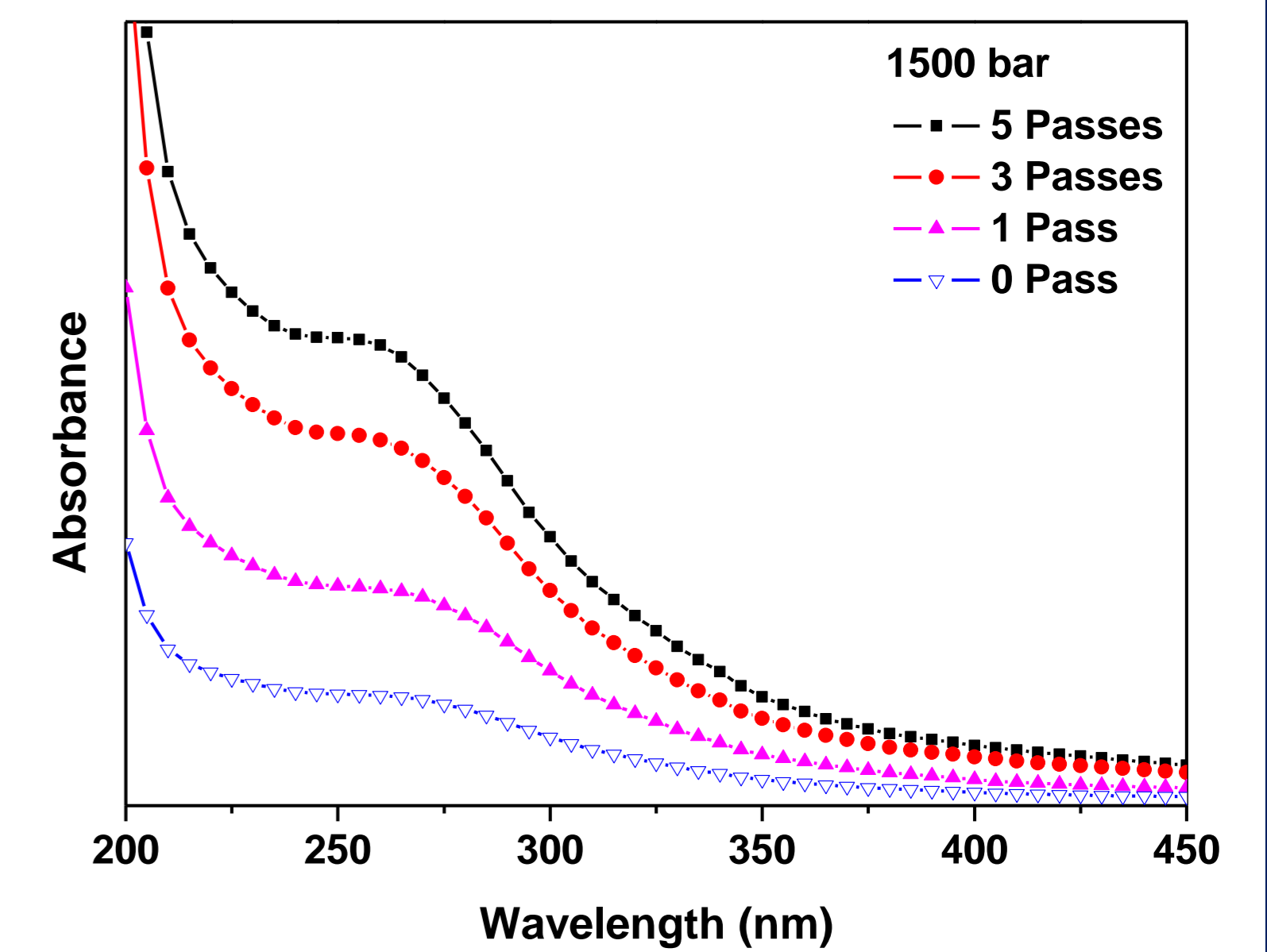
### Molecular Weight



### FT-IR Spectrum



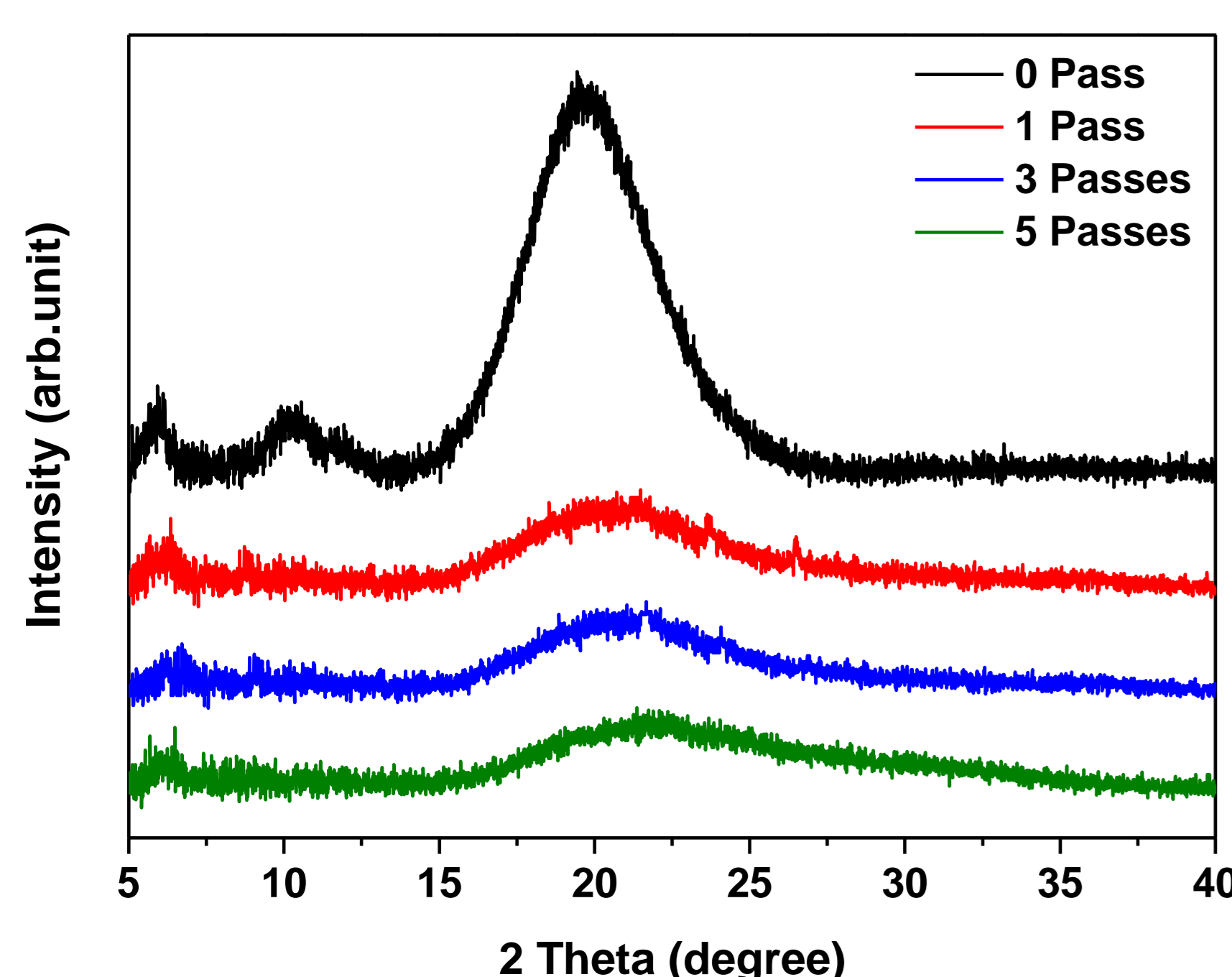
### UV-Vis



- HPH treatment produces significant changes in the viscosity and molecular weight of the  $\beta$ -glucan solution.
- As the pressure and the number of pass increases, the polymer solution shows a significant decrease of viscosity and molecular weight.

- High Depolymerization Effect, Short Process Time and No Waste Water (Green Chemistry)

### XRD



- The intensity characteristics of the peaks tend to decrease with increasing numbers of passes under high pressure homogenization.
- A decrease in crystallinity occurs due to the destruction of the crystal structure of chitosan as a result of the cleavage of the glycosyl bonds

## 4. Conclusion

- In the HPH process, the pressure and the number of passes increases make viscosity and molecular weight decrease without any acid/alkali solution (Green Chemistry).
- The FT-IR spectra indicated no obvious modification of chemical structure of polymer before and after HPH treatment.
- HPH has been shown to be a valid tool to reduce molecular weight of natural polymer (polysaccharides structure).

