

# Improvement of bio-degradability and physical properties of waterborne polyurethane for bio-adhesive application

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## Abstract

Waterborne polyurethanes (WPU) was synthesized using the polycaprolactone diol (PCL) as the polyol, and 4,4'-methylene dicyclohexyl diisocyanate (H<sub>12</sub>MDI) as the isocyanate. The crosslinked WPU was obtained by the castor oil (CO) with the three functionalities. The synthesis was designed using PCL, castor oil and H<sub>12</sub>MDI as soft segment part, dimethylolbutanoic acid (DMBA) for the ionization, and trimethylamine (TEA) as neutralizer based on different molecular weight of prepolymer. Physical properties (the adhesion and biodegradation) as the bio-adhesives were studied through fourier-transform infrared spectroscopy (FT-IR), universal testing machine (UTM), contact angle, field emission-scanning electron microscopy (FE-SEM), degrading-enzyme systems based on the different molecular weight of waterborne polyurethanes

## Objective

- To synthesize the biocompatible waterborne polyurethanes (B-WPUs) through two-step processing
- To evaluate the castor oil effect on the mechanical properties of B-WPUs
- To investigate adhesion properties and the enzymatic biodegradability on the surface of collagen

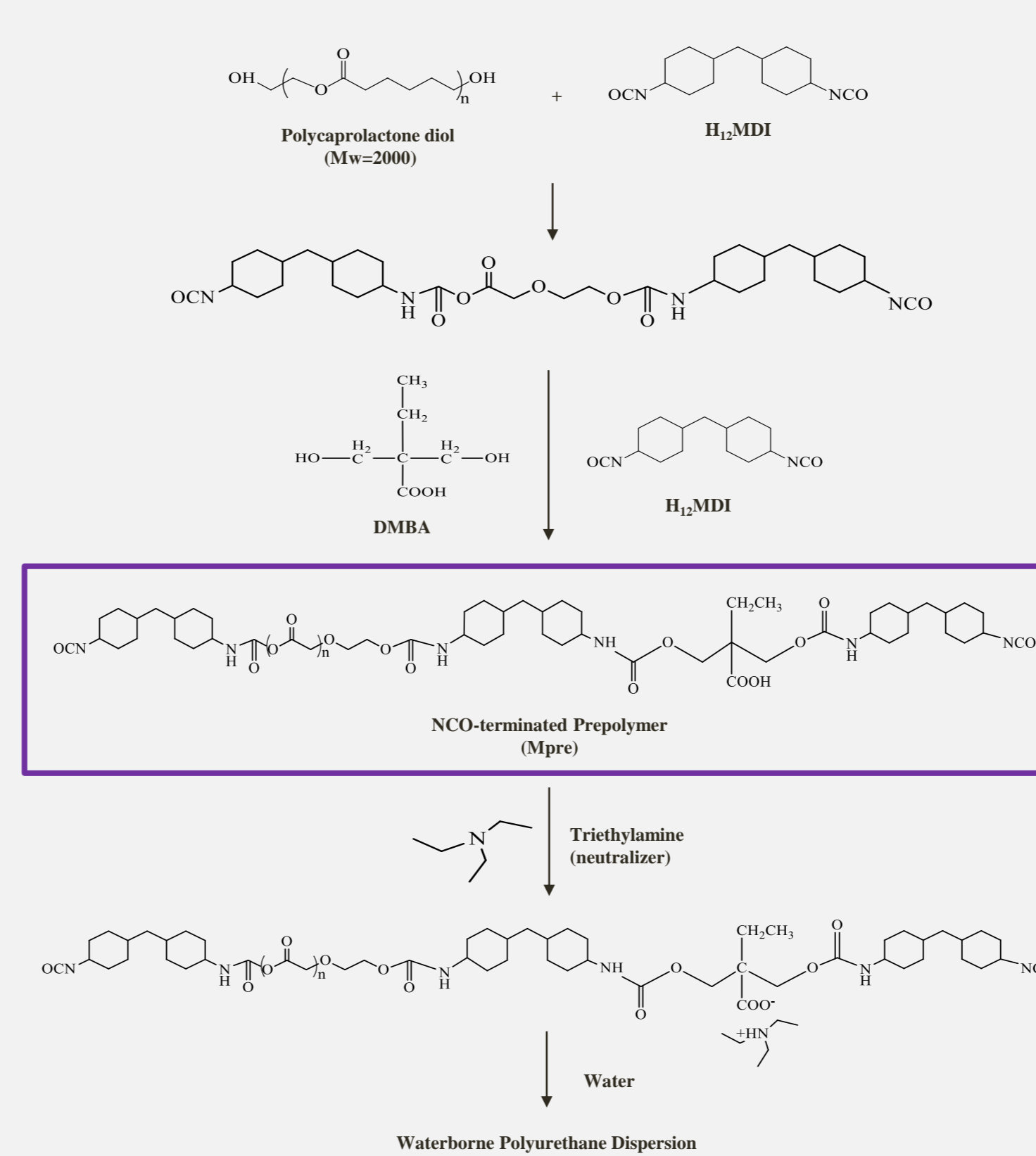
## Experimental

### Formulation

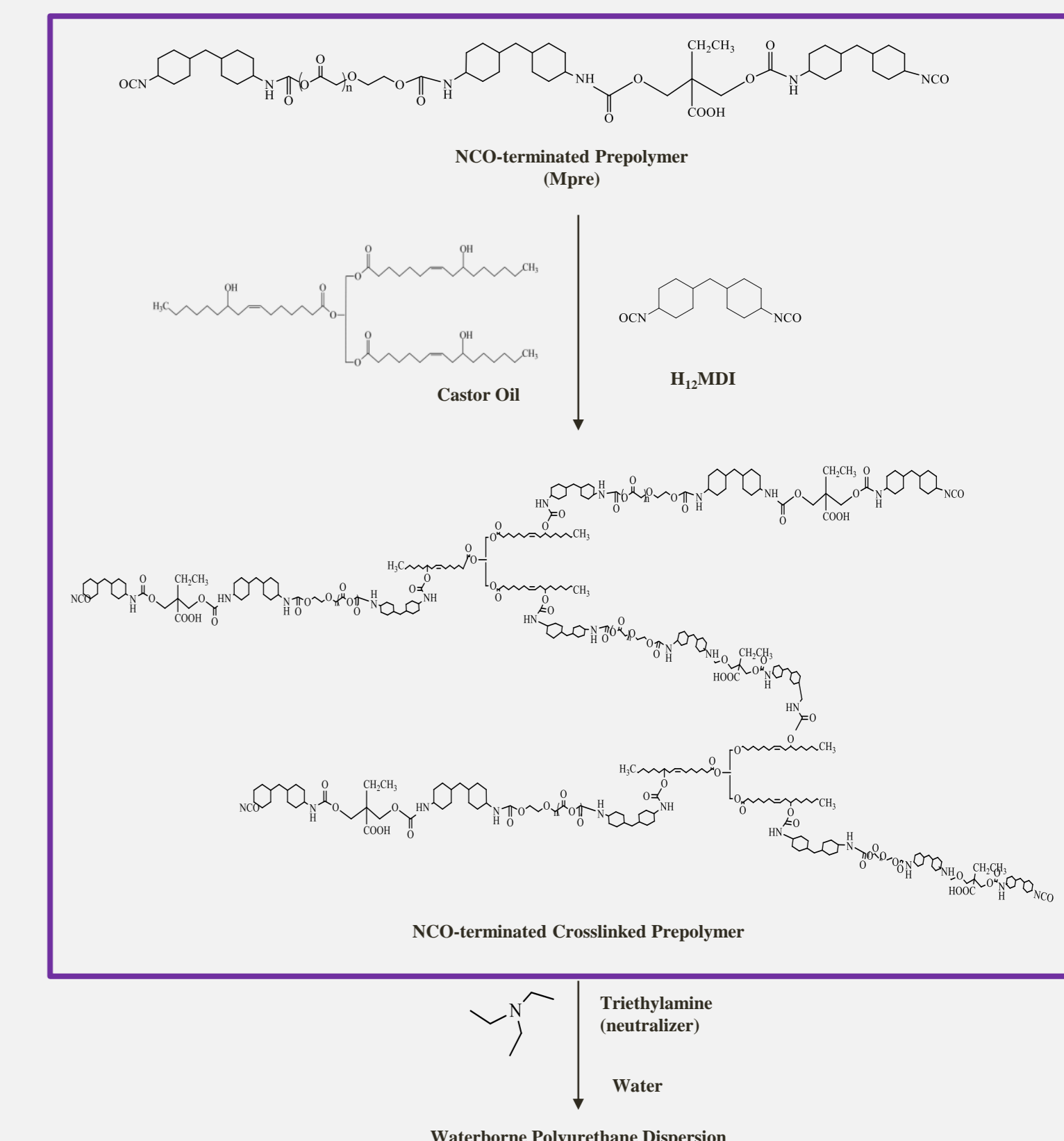
	Mpre	Series	Soft segment		Ionic group		Castor Oil		TEA
			PCL(530)	H <sub>12</sub> MDI	DMBA	H <sub>12</sub> MDI	Castor Oil	H <sub>12</sub> MDI	
#1	3000	WPU-3	0.0293	0.0393	0.0101	0.0101	-	-	0.0101
#2		WPU-3C	0.0293	0.0393	0.0101	0.0101	0.0050	0.0050	0.0101
#3	6000	WPU-6	0.0310	0.0360	0.0101	0.0101	-	-	0.0101
#4		WPU-6C	0.0310	0.0360	0.0101	0.0101	0.0025	0.0025	0.0101
#5	10000	WPU-10	0.0316	0.0346	0.0101	0.0101	-	-	0.0101
#6		WPU-10C	0.0316	0.0346	0.0101	0.0101	0.0015	0.0015	0.0101
#7	30000	WPU-30	0.0323	0.0333	0.0101	0.0101	-	-	0.0101
#8		WPU-30C	0.0323	0.0333	0.0101	0.0101	0.0005	0.0005	0.0101

Solid:30g, Ionic group:5wt%

### Scheme 1

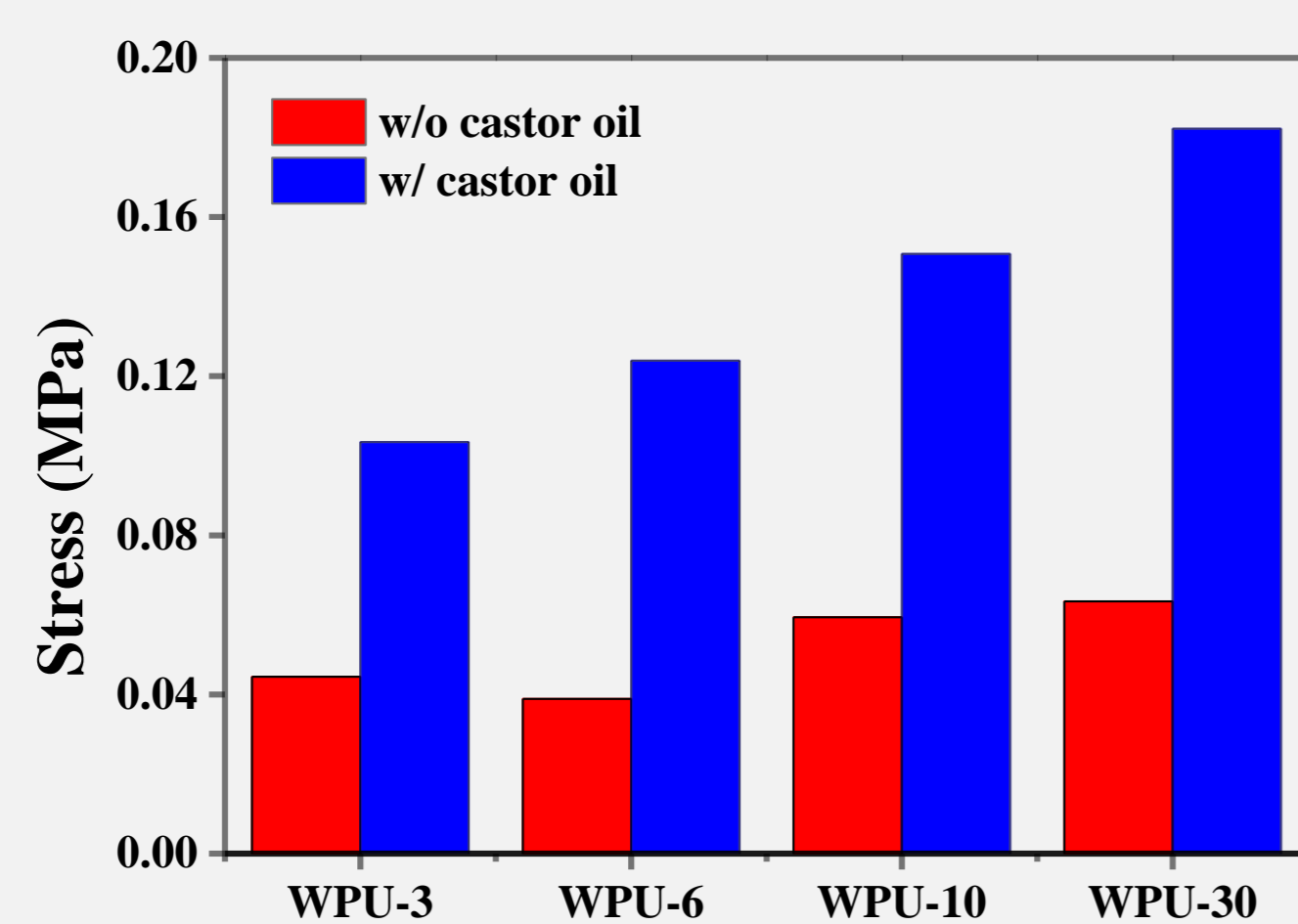
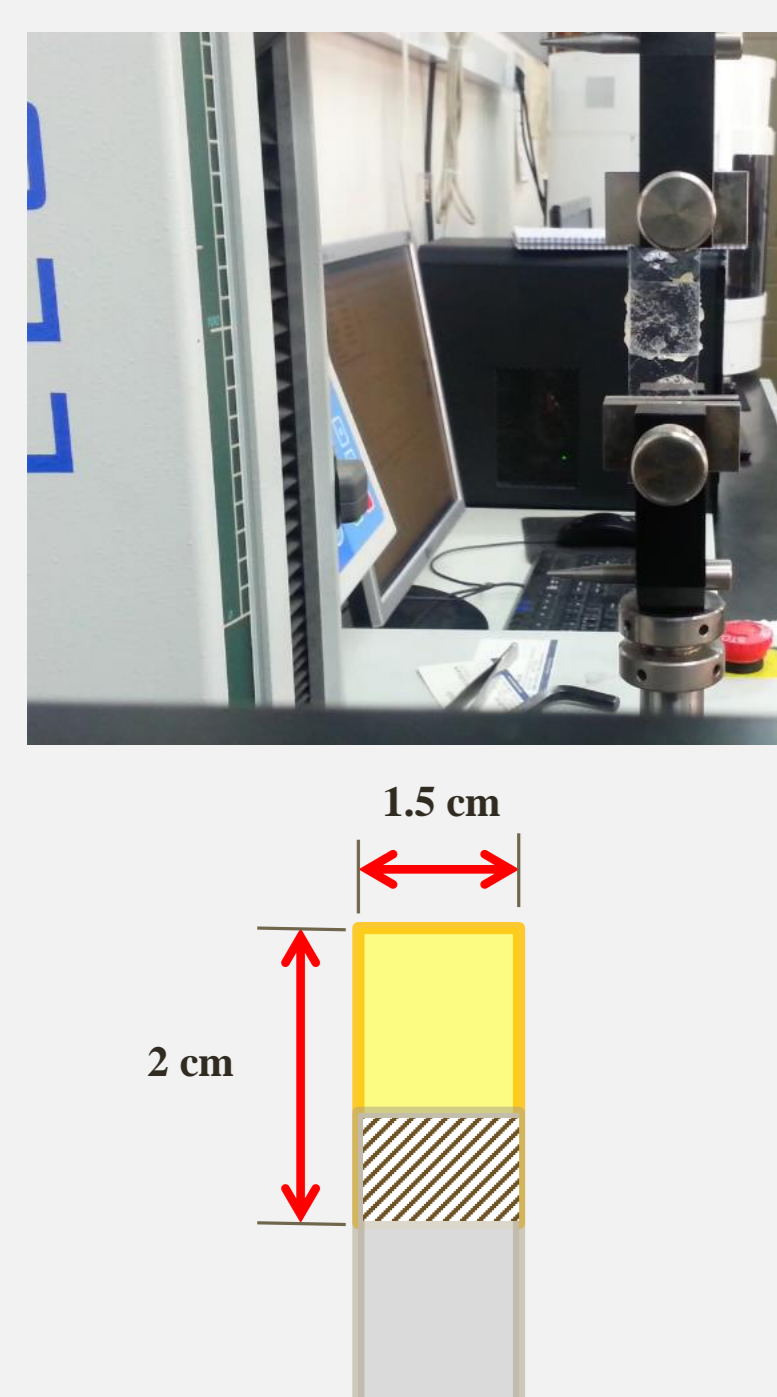


### Scheme 2

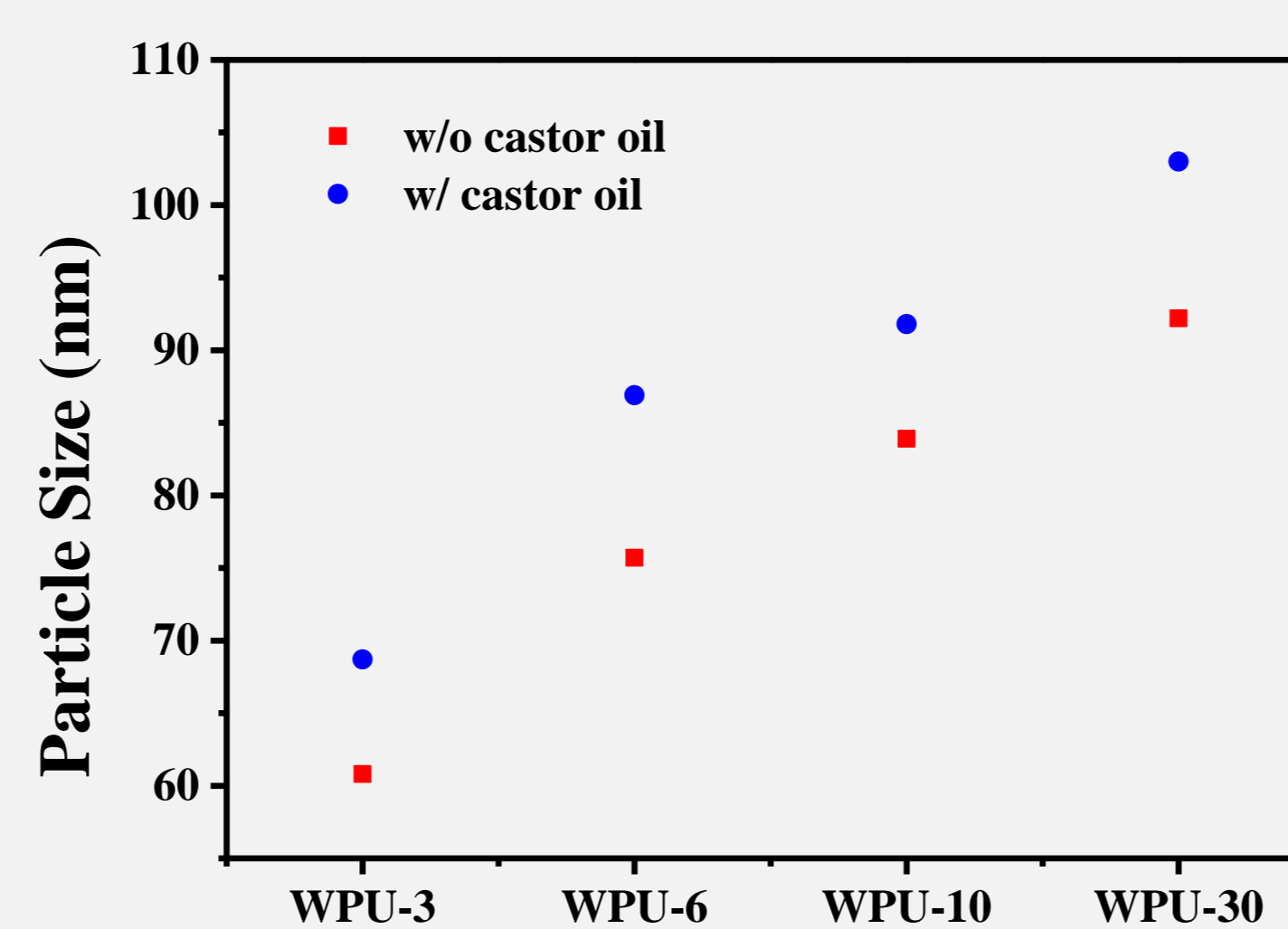


## Results

### Adhesion Tests of B-WPUs

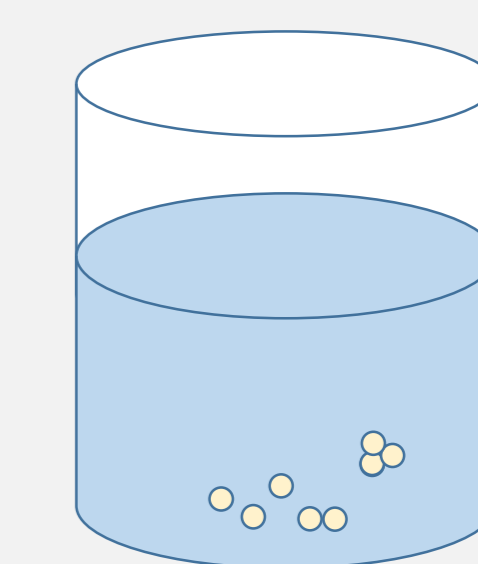


### Particle Size of B-WPUs

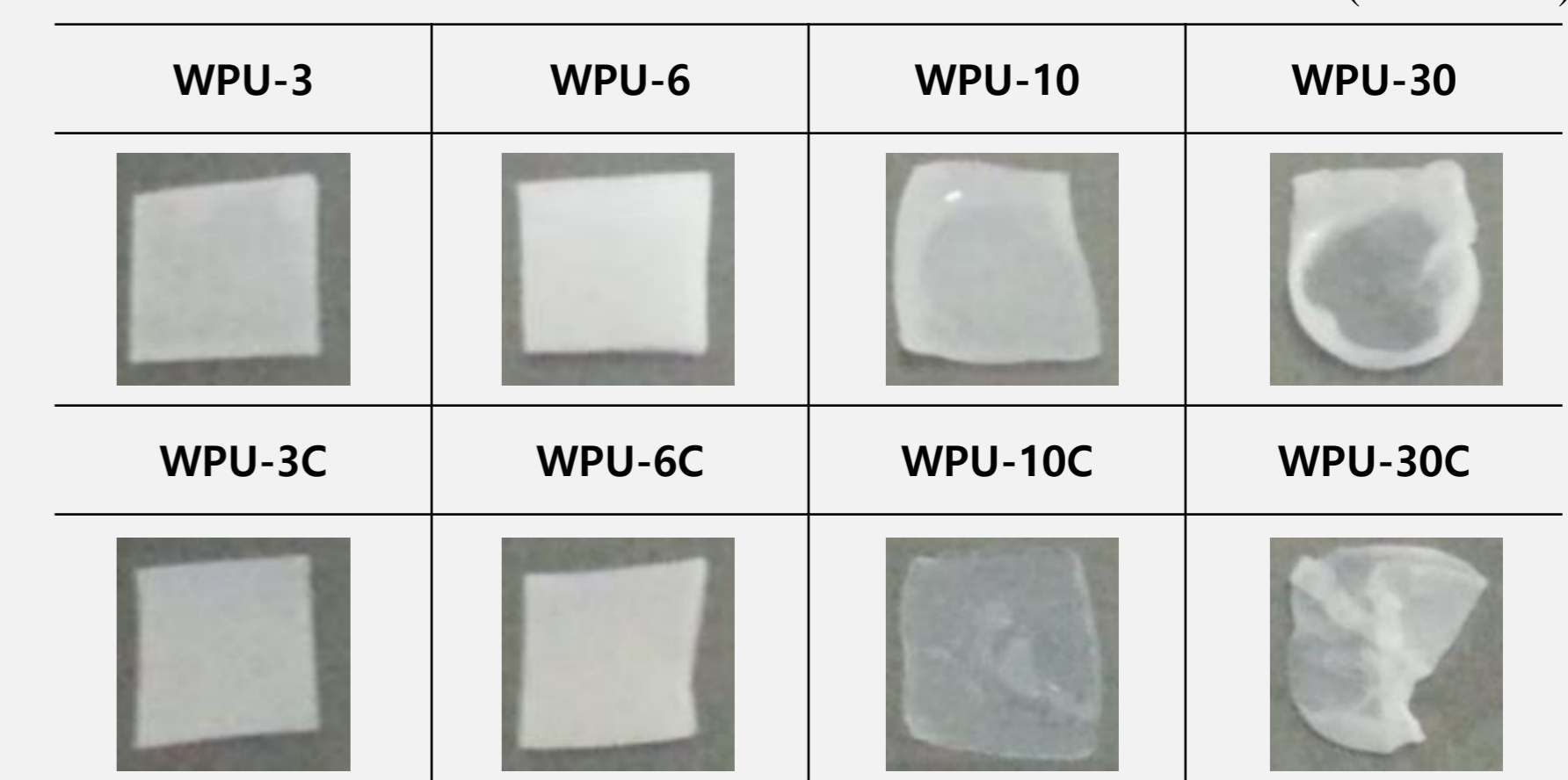
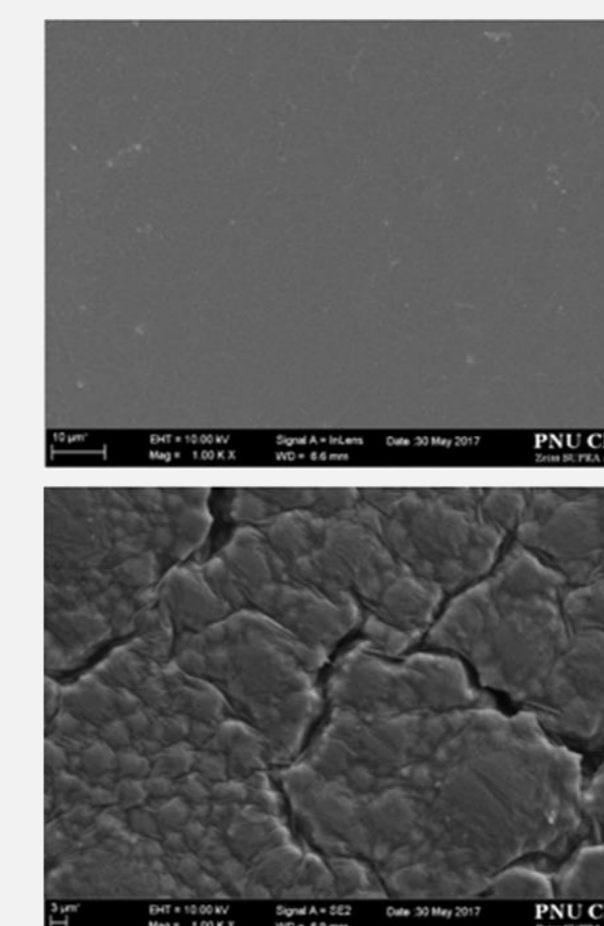


### Enzymatic Degradation Test

Film  
(1cm x 1cm x 0.2 cm)  
PH 7.2 buffer solution  
Enzyme powder 5mg/ml



(after 2week)



## Conclusion

- A molecular weight series of Castor oil-based B-WPU were successfully controlled
- Mechanical properties can be adjusted to suit particular wound closure

## Acknowledgement

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