



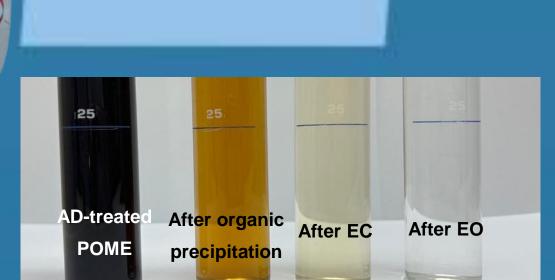
The tannin-protein complex

High-value product from waste facilitating wastewater treatment & water reuse

Tanninnov is a tannin product harvested from wastewater from palm oil extraction using an environmentally friendly process. **Tanninnov** has the properties of a fiber binder and has antioxidant effects. Therefore, it can be developed into other products such as tannin glue, animal dietary supplements, antioxidant packaging film, and an inhibitor of scale and corresion in boilers

corrosion in boilers.

Tannin harvesting is an important step that makes wastewater treatment from palm oil extraction technically and economically feasible.



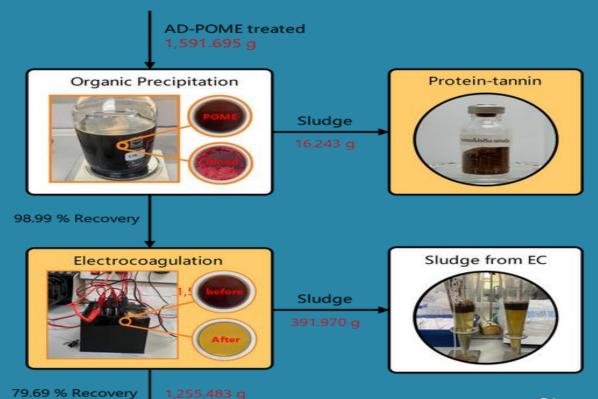
TANNINOV

Parameter	Unit	Tanninnov Crude tannin- protein complex
рН	-	9.52 ± 0.05
Tannin concentration (concentrate form)	mg/L	1,524.12 ± 35.34
Tannin content	mg/g	16.79 ± 0.87
(dry product)	%	1.68
Antioxidant activity	µmol Fe ²⁺ /g dried weight	51.50 ± 0.81
7 thioxidant dollvity	µmol Fe ²⁺ / 100g dried weight	± 81 150,5
Protein concentration (concentrate form)	mg/L	3,659.46 ± 112.32
Protein content (dry product)	mg/g	43.65 ± 2.35
	Crude tannin-protein	Commercial tannin

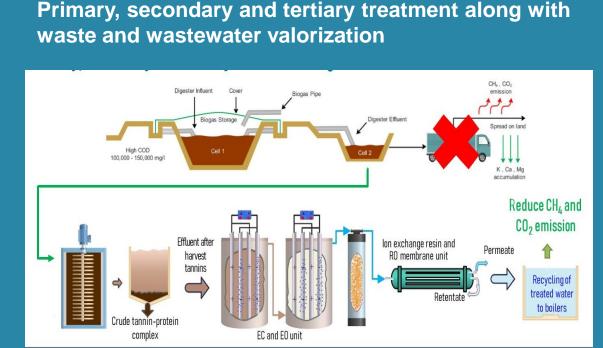
This resulted in a reduction of 15,240 tons of $CO_{2 \text{ eq}}$ per year and the treatment and recycling of water for use in the factory.

Key methodology

Organic precipitation, Electrocoagulation, Electrooxidation



Sludge



Characteristics of AD-treated POME from a palm oil factory and
after treatment

	after treatment				
Parameter	Unit	AD-treated POME	Properties of water	Factory Wastewater	
i arameter	Onic	AD-lifeated ONL	after treatment	Drainage Control	
pН	-	8.32 ± 0.06	4.80 ± 0.11	5.5-9.0	
TSS	mg/L	2,266.67 ± 230.94	0.58 ± 0.06	< 50	
TDS	mg/L	6,841.25 ± 144.96	< 0.001	< 3000	
Conductivity	mS/cm	12.93 ± 0.01	21.40 ± 0.20		
COD	mg/L	5840.80 ± 78.40	19.41 ± 4.80	< 120	
Phenol	mg/L	272.40 ± 1.62	0.58 ± 0.04	< 1	
Turbidity	NTU	135.33 ± 0.58	0.13 ± 0.02		
Total hardness	mg/L	2,602.50 ± 119.83	6.14 ± 0.38		
Ammonium	mg/L-N	37.98 ± 0.10	0.20 ± 0.03		
Color	ADMI	13,337.5 ± 1,178.60	16.29 ± 1.38	< 300	

Examples of products developed

from **Tanninnov**

Property	Binderless fiberboard	Fiberboard with Tanninnov as organic adhesive
Modulus of rupture (MPa)	0.667 ± 0.056	10.588 ± 1.057
Modulus of elasticity (MPa)	69.86 ± 0.81	1,446.67 ± 112.47
Thickness swelling after 1 h (%)	89.883 ± 0.677	38.135 ± 3.526
Water absorption (%)	216.67 ± 17.54	70.38 ± 7.63





Tanninnov packaging biofilm: An antimicrobial biofilm made from Tanninnov, designed to extend the life of the products liable to oxidation. It is environmentally friendly and biodegradable.



Electrooxidation