

Development of Photo-Switching Ocean-Degradable Plastics with Edibility

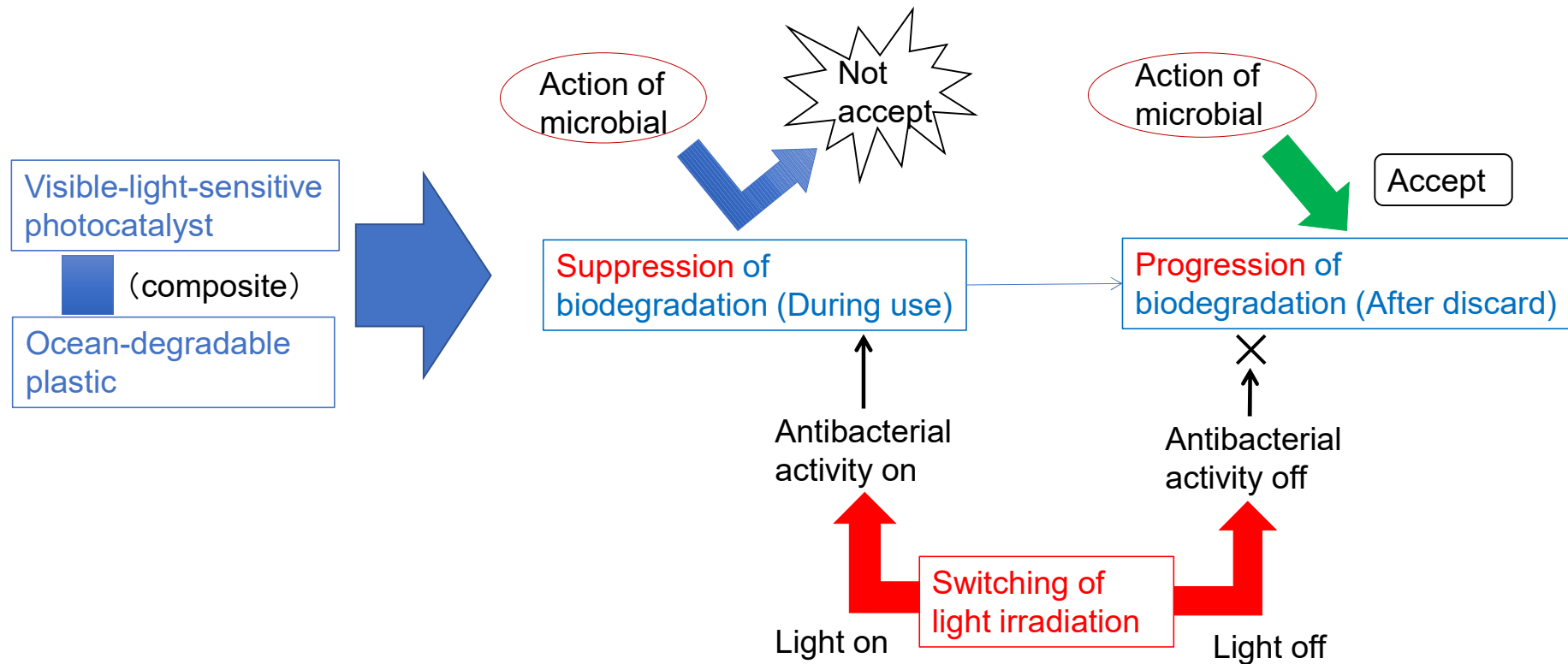
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Implementing organizations :Japan Advanced Institute of Science and Technology, Kobe University,
Nagoya University, Kagoshima University, Tokyo University of Science,
Tokyo University of Agriculture and Technology,
National Institute of Advanced Industrial Science and Technology(AIST),
Osaka Research Institute of Industrial Science and Technology(ORIST).

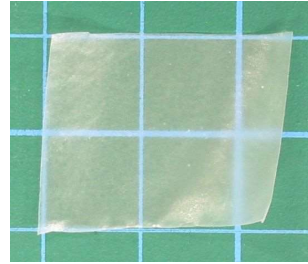
Biodegradation control model in ocean-degradable plastic composite by on/off light irradiation



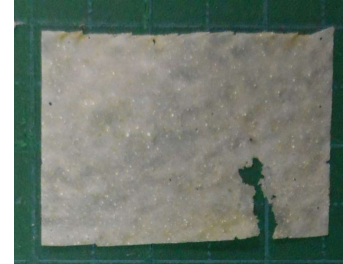
Ocean-degradability evaluation



Sinking in the sea for a certain period of time



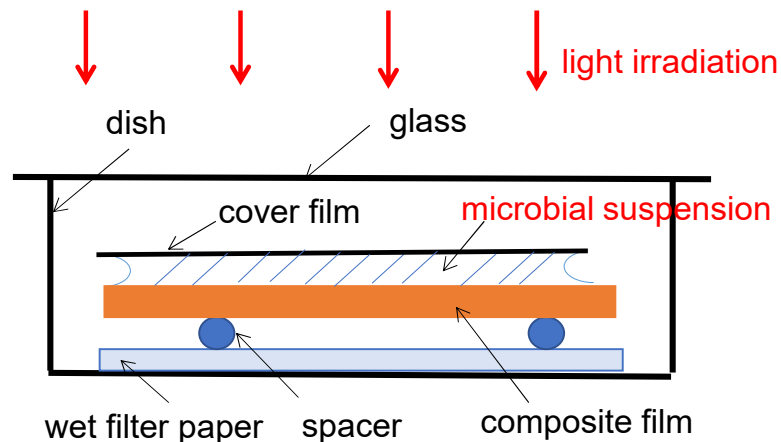
Before sinking



After sinking

→ Evaluate weight retention rate

Antibacterial activity evaluation



→Contact the bacteria with the photocatalytic composite film under light irradiation, and measure the increase or decrease in the viable bacteria cell counts after a certain period of time.

If significant correlations can be found between the two evaluations, it will be possible to make predictions about ocean-degradability from the antibacterial activity evaluation.

End goal

For ocean-degradable plastics composited with antibacterial photocatalysts, antibacterial activity will be evaluated based on the assumption of molding, shape, and purpose of use, and the characteristics of the photo-switching effect will be clarified to systematize knowledge that can be used to customize the type and concentration of additives for practical use.

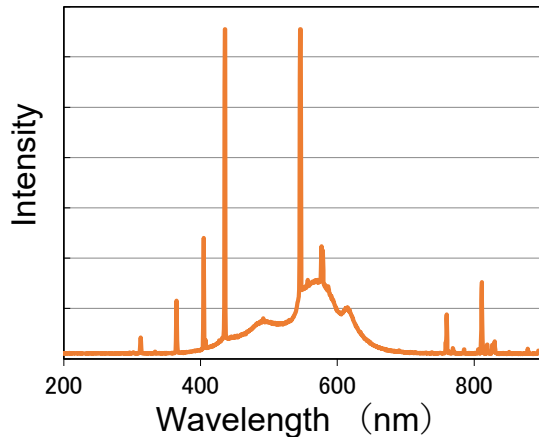
Development Items

- Development of antibacterial activity evaluation system (light source, irradiation intensity, target microorganism, etc.)
- Evaluation of photo-switching efficiency (antibacterial activity) at the laboratory tests
- Evaluation of the correlation with actual environmental tests (ocean-degradability evaluation)

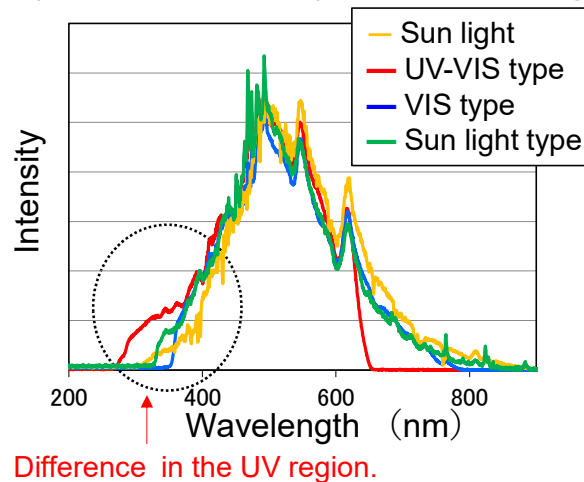
Development of antibacterial activity evaluation system

light source

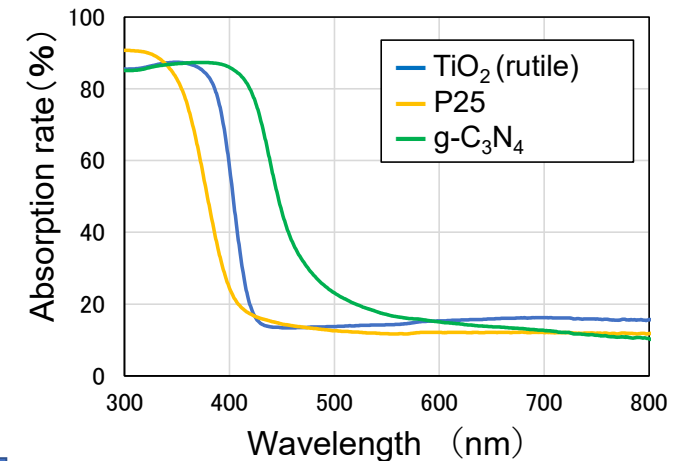
White fluorescent lamp (official method)



Xenon lamp (simulated sunlight)

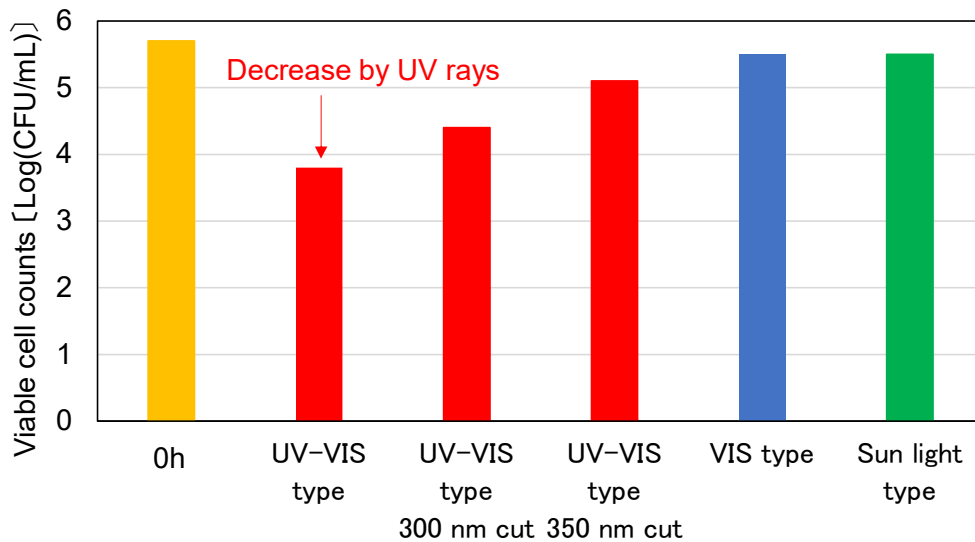


Absorption spectrum of photocatalyst



Antibacterial activity using a film without photocatalyst

Viable cell counts after 4 h under Xenon lamp irradiation (300 Lx)

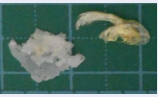
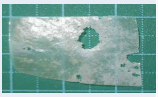
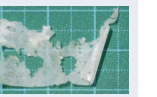
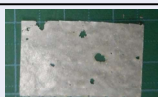

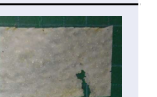
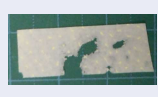



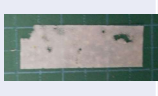



In the antibacterial activity evaluation on visible light responsive photocatalyst (official method), white fluorescent lamp (indoor light) was used as the light source. Compare fluorescent lamps and xenon lamps (simulated sunlight) for outdoor (sunlight) use, and select an appropriate light source system.

In case of xenon lamp with high UV light (UV-VIS type), viable cell counts decrease by UV light influence. In case of xenon lamps with low UV light (VIS type, sun light type), viable cell counts do not decrease.

Actual environmental test (ocean-degradability evaluation)

Kobe (2021.11.26-2021.12.9) (1.5 m depth)

PCL				
	Weight retention ratio (%)	12.9	84.6	42.8
			46.8	
PCL+				
Photocatalyst				
①	Weight retention ratio (%)	89.6	79.4	89.8
			86.3	
PCL+				
Photocatalyst				
②	Weight retention ratio (%)	48.1	69.1	51.1
			56.1	
PCL+				
Photocatalyst				
③	Weight retention ratio (%)	69.3	70.9	74.1
			71.4	

