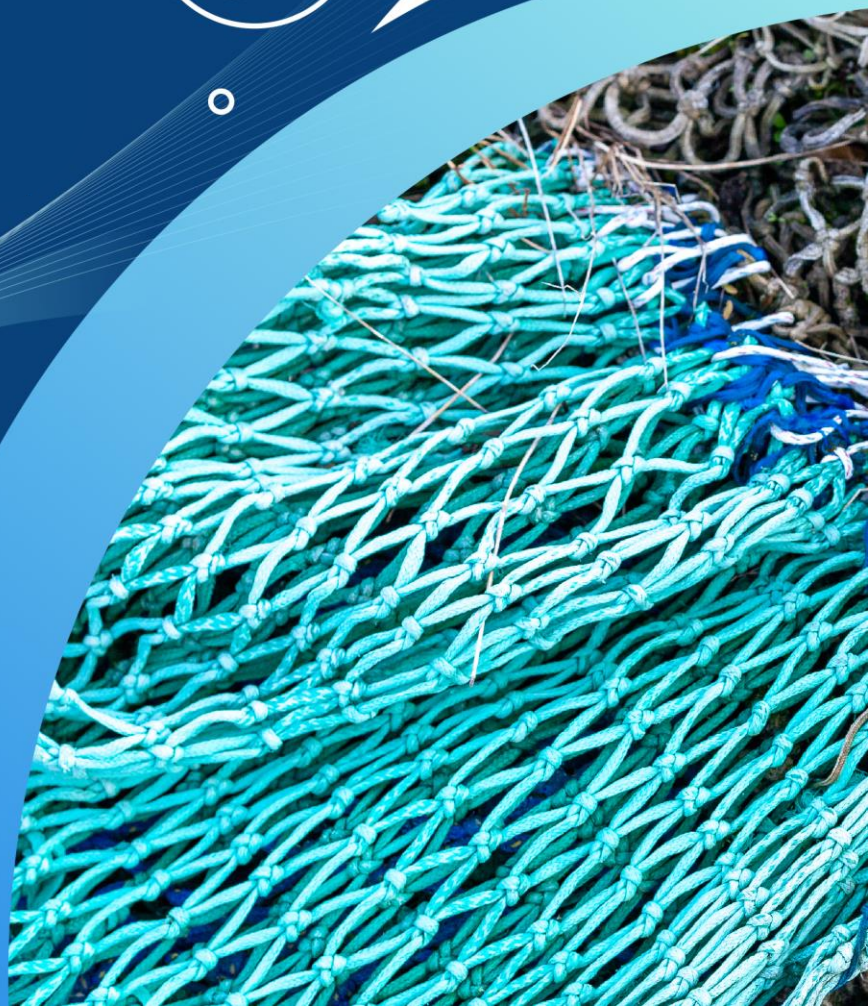
Biodegradable Fishing Nets

Reducing ghost fishing &

protecting the marine ecosystem



Pukyong National

University

Park SuBong

01 Advantages & Disadvantages of Polyamide (Nylon) Fiber

- In 1935, it was developed by DuPont USA, and industrialized after WWII.
- Introduced to Korea in 1966, it was used in 41 industries including gill nets and fish pots.

Advantages

Affordable

Robust

Easy to process

Disadvantages

Non-biodegradable

Environment Destruction

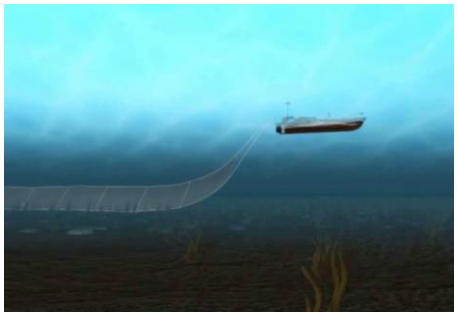
Air Pollution

02 Nylon Net Problems I (Non-biodegradable)

Nylon fishing nets are biodegradable but, it takes more than 500 years

- Nylon invented in 1935

Durable and **highly** flexible, effective in catching fish



- Net loss due to typhoons

- Creates marine litter

02 Nylon Net Problems Ⅱ (Destruction of marine animal habitats)

Annually, 24,000 tons of nets are discarded in Korea

Fish pots discarded in the ocean

Nets floating in the water (*Source: FIRA)

A net covering artificial reefs

Discarded nets retrieved from the ocean

02 Nylon Net Problems Ⅲ (Depleted fish stocks due to ghost fishing)

Over a year, fish deaths due to abandoned nets in our oceans reach

95,000 tons ($3.8 billion)

Fish caught and killed in gillnets

Snails caught and killed in fish pots

- **Ghost fishing**: The phenomenon of fish getting trapped and dying in nets discarded in the ocean.

02 Nylon Net Problems IV (Ship safety and threat to marine life)

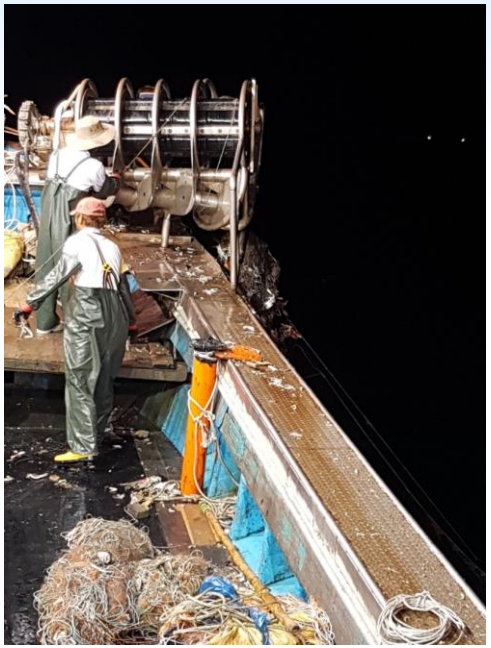
Over the span of 5 years (2015–2019) in Korea, there were 2,038 ship accidents caused by discarded nets.

Annually, 130,000 marine animals die due to discarded nets globally.

※ One million seabirds

Source: Seaspiracy

02 Nylon Net Problems



02 Nylon Net Problems








03 Biodegradable Fishing Net Development Research

Research started in 2002

Conditions for biodegradable nets

01 They should be decomposable!

그러나

02 They shouldn't tear during use!

그리고

03 They should be good at catching fish!

04 What is a biodegradable fishing net?

☑ It is a net made from biodegradable materials that break down over time by microorganisms into water and carbon dioxide.

Biodegradable Net

Microorganism

Water

+

Carbon dioxide

05 World's first biodegradable fishing net

Biodegradable Resin (**PBS material**)

Net yarn

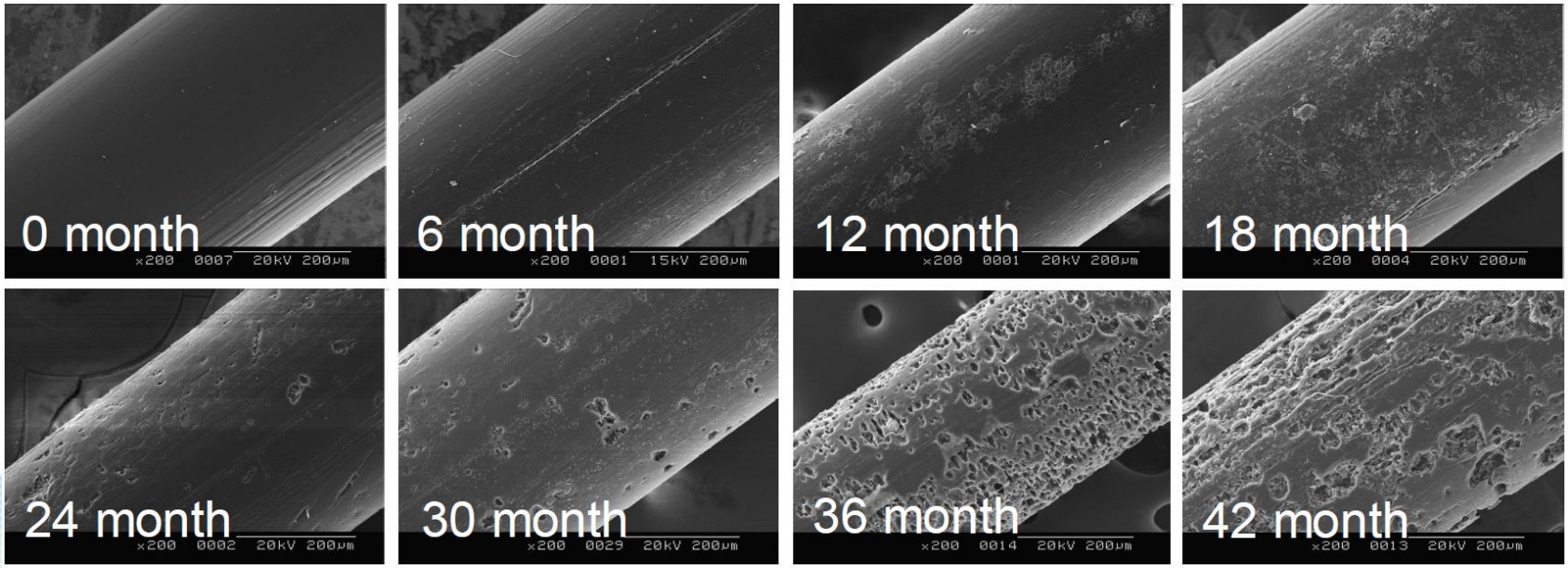
Biodegradable fishing net

Fishing performance test (Checking the amount caught)

World's First Development in 2005

05 World's first biodegradable fishing net

Surface degradation of biodegradable nets according to marine submergence period



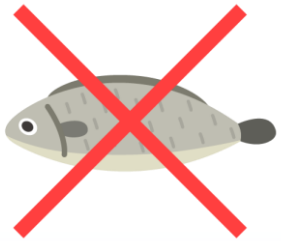
06 First biodegradable net promising but misses the mark

Net performance catching test

(crab)

Weak,
easily torn, and
catching rate
drops by 10% ...

Suitable for crabs



Not suitable for fish

06 First biodegradable net promising but misses the mark

어업인

- 가격이 비싸다
- 강도가 약하다
- 유연성이 부족하다
- 탄성이 부족하다
- 어획성능이 떨어진다

생산업체

- 원료가 비싸다
- 편망이 어렵다
- 열처리가 어렵다
- 보관이 어렵다
- 그물이 부푼다

07 Research on improving biodegradable fishing net performance

2016–2021

Research on Eco-friendly biodegradable fishing net performance enhancement and standardization

KIMST Fisheries Commercialization Technology Development project, research budget 3.5 Billion won, ANCO Bioplastics Co., Ltd., Inha University, Jeju Marine Gillnet Fishermen's Association

Biodegradable fishing net performance improvement goals

01 Decomposition must be fast!

02 Strength and flexibility must be enhanced!

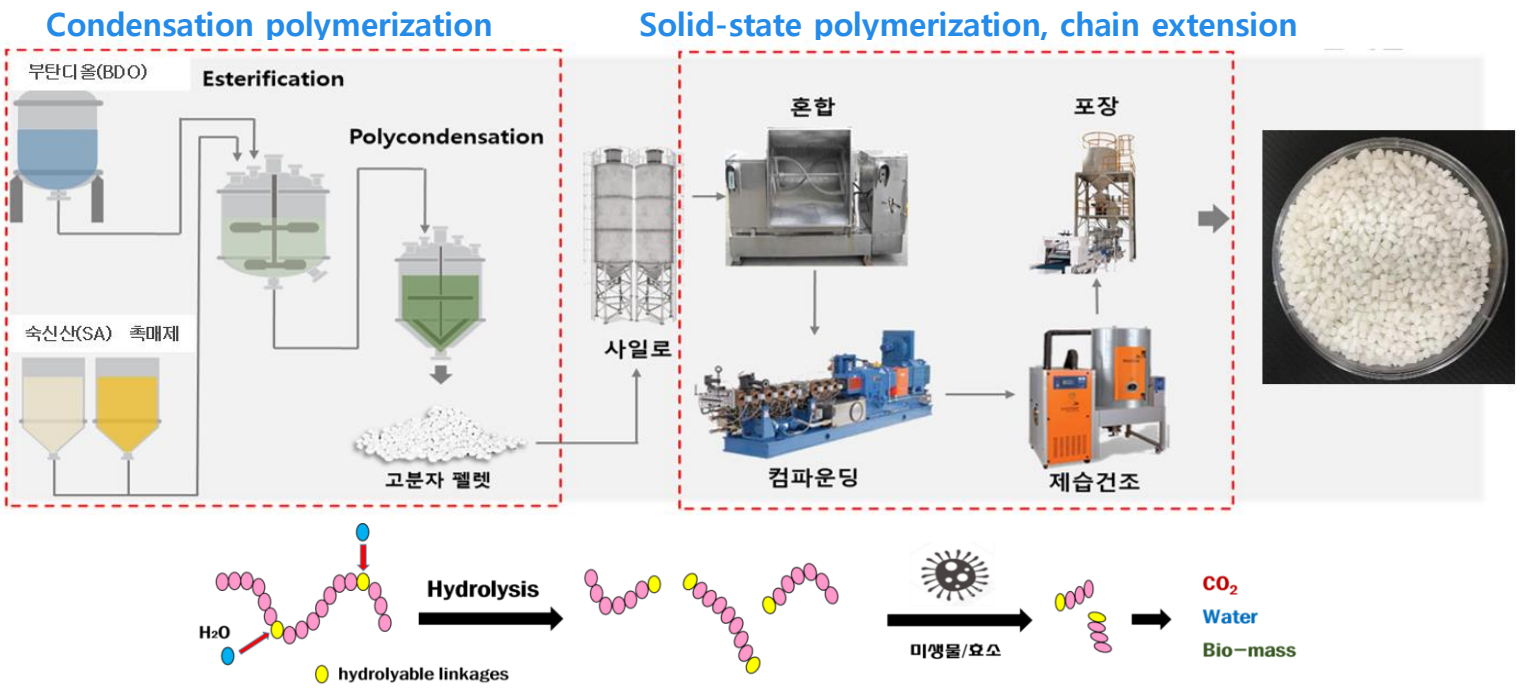
03 Performance of catching fish must be ensured!

07 Research on improving biodegradable fishing net performance

Research and development of biodegradable fishing net marterials

Macromolecule Resin (Material)

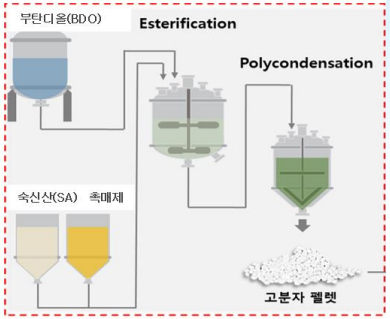
The physical and chemical characteristics are determined by factors such as molecular structure, molecular weight, molecular weight distribution, and molecular structural features (crystal structure, degree of crystallinity).



- **Macromolecule** : A polymer composed of low molecular weight units (monomers) linked together to form a high molecular weight structure, typically encompassing molecules with 10,000 or more units.

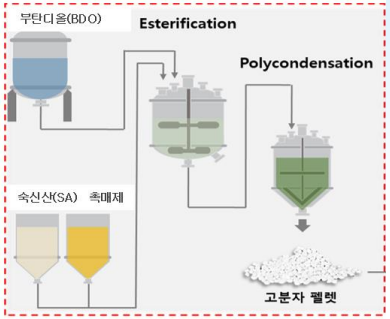
07 Research on improving biodegradable fishing net performance

Research and development of biodegradable fishing net marterials



07 Research on improving biodegradable fishing net performance

Research and development of biodegradable fishing net marterials



07 Research on improving biodegradable fishing net performance

Research and development of biodegradable fishing net marterials

07 Research on improving biodegradable fishing net performance

Research and development of biodegradable fishing net marterials

☑ Degradation testing of biodegradable fishing net material under composting conditions

Experiment for environmental label certification (EL724) acquisition

Material

High-temperature Pressure

Sample Fabrication(film form)

Before Burying

Burying Test

Measuring weight after burying

- **EL724** : Ministry of Environment Notification No. 2016-134. Environmental certification standards for biodegradable resin products issued by the Korea Environmental Industry & Technology Institute.

07 Research on improving biodegradable fishing net performance

Development of four new materials for biodegradable fishing nets (early 2020)

☑ **Four new ingredients**
PBEAS, PBEAS^{+AH}, PBES, Bio-PBS

- **PBEAS** : Improvements in intensity and flexibility compared to conventional material (PBS)
  Poly (butylenesuccinate-co-butyleneadipate-co-ethylenesuccinate-co-ethyleneadipate)
- **PBEAS^{+AH} :** Enhanced biodegradability by adding biodegradation enhancers to PBEAS Resin
  Poly (butylenesuccinate-co-butyleneadipate-co-ethylenesuccinate-co-ethyleneadipate) + anti hydrolysis agent
- **PBES :** Similar intensity and improvements in flexibility compared to conventional material (PBS)
  Poly (butylenesuccinate-co-ethylenesuccinate)
- **Bio-PBS :** More eco-friendly than conventional material (PBS)
  Biomass based-Polybutylenesuccinate

07 Research on improving biodegradable fishing net performance

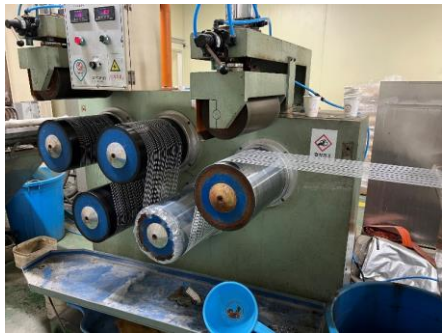
Research on biodegradable net manufacturing process (irradiation)

항목	방사수율* / 단사율**	Cylinder temp.(℃)	Head (℃)	Dies (℃)	Godet roller (rpm)				Heat treatment temp.(℃)			
		C1~C5		1st	2nd	1st	2nd	3th	4th	1st	2nd	3th	4th
BDP-N13	97.2% / 4.8%	200~213	218	218	218	11.0	31.0	75.4	69.6	4	77	83	88
BDP-N19	97.9% / 3.6%	201~212	218	217	217	11.0	31.1	75.5	69.6	4	77	82	86

- **Irradiation rate**: The calculation of net weight of produced netting after continuous operation for 4.5 days following the input of 1,000kg of raw material.
- **Single yarn rate**: The calculation of single yarn occurrence among produced bobbins

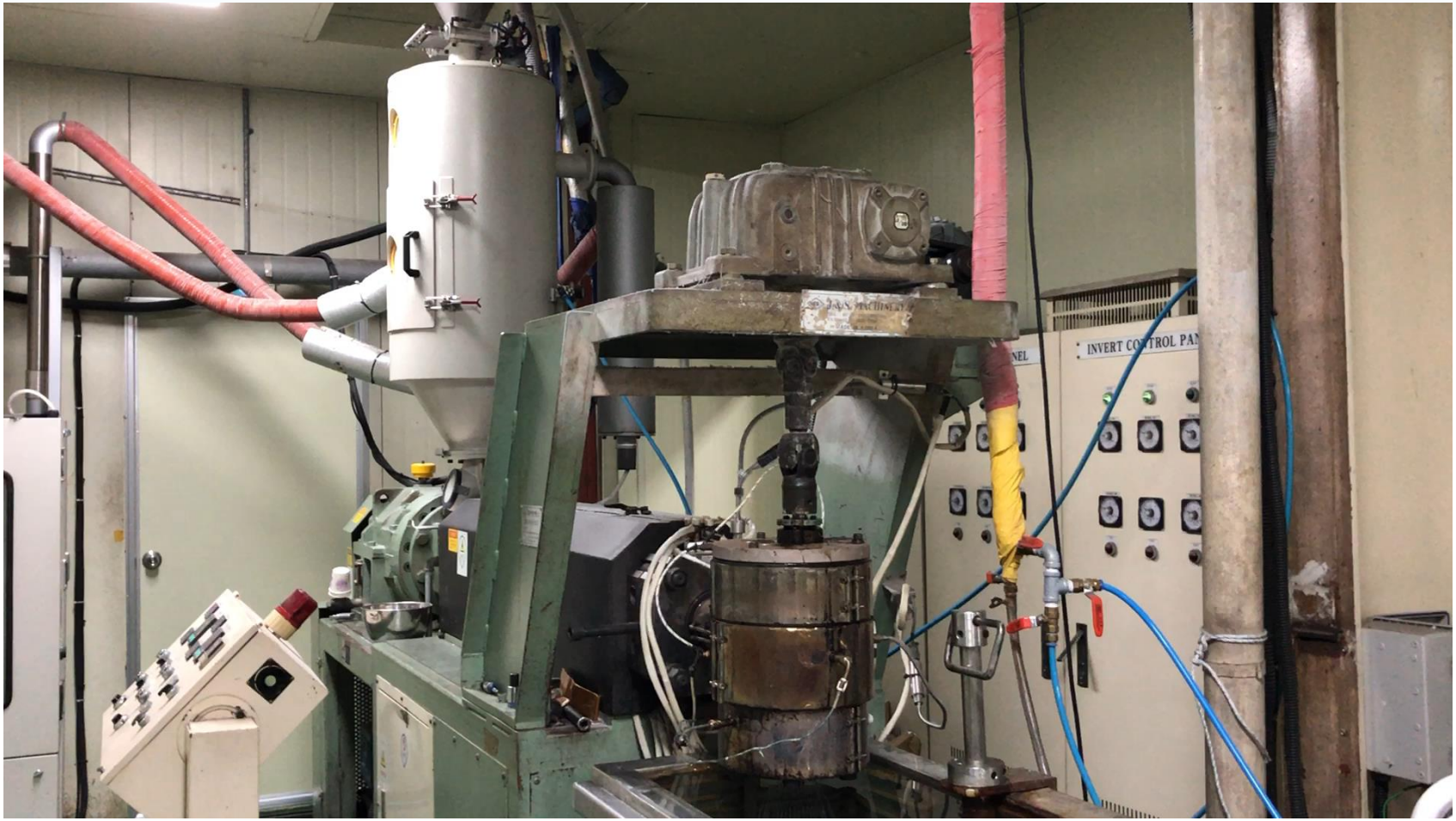
07 Research on improving biodegradable fishing net performance

Research on biodegradable net manufacturing process (irradiation)



07 Research on improving biodegradable fishing net performance

Research on biodegradable net manufacturing process (irradiation)

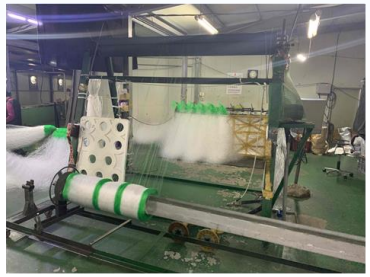


07 Research on improving biodegradable fishing net performance

Research on biodegradable net manufacturing process (seining and heat treatment)

Haul

Seining



Switching the net horizontally and vertically

Fixing the net

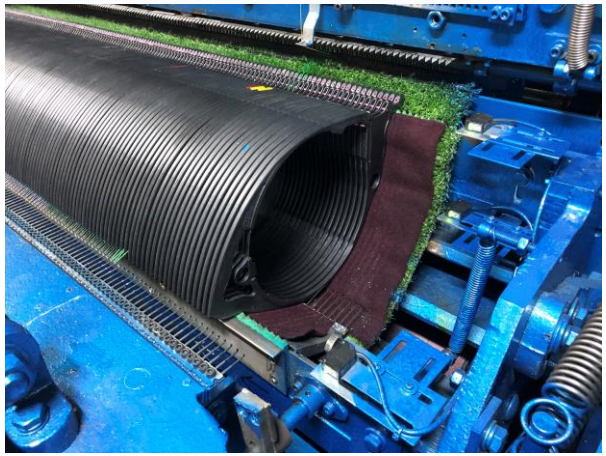
Heat Treatment

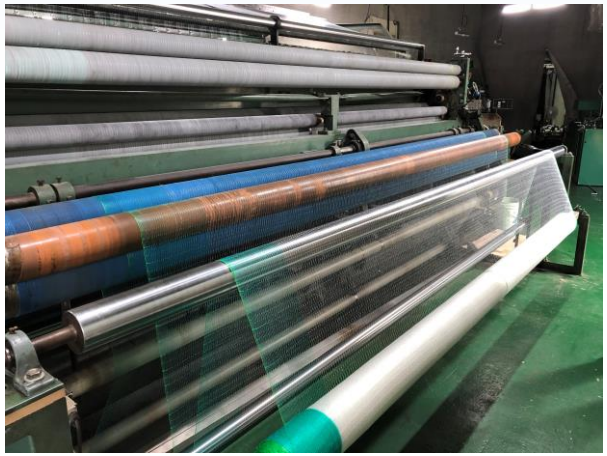
Drying & Packaging

항목	회전수 (회/분)	Loss Time (분)	편망시간 분/필	열처리 온도(℃)	열처리 시간(분)	불량품 (필)	손실률 (%)	불량내용
PBS	15.4	12	132	82	30	2	2	결절
PBAST	16.4	14	142	72	35	5	5	결절 2 부풀음 3
BDP-N17U (4차년)	15.4	12	130	82	25	3	3	단사 /결절
BDP-N19	15.4	13	131	83	25	2	2	단사

07 Research on improving biodegradable fishing net performance

Research on biodegradable net manufacturing process (seining and heat treatment)



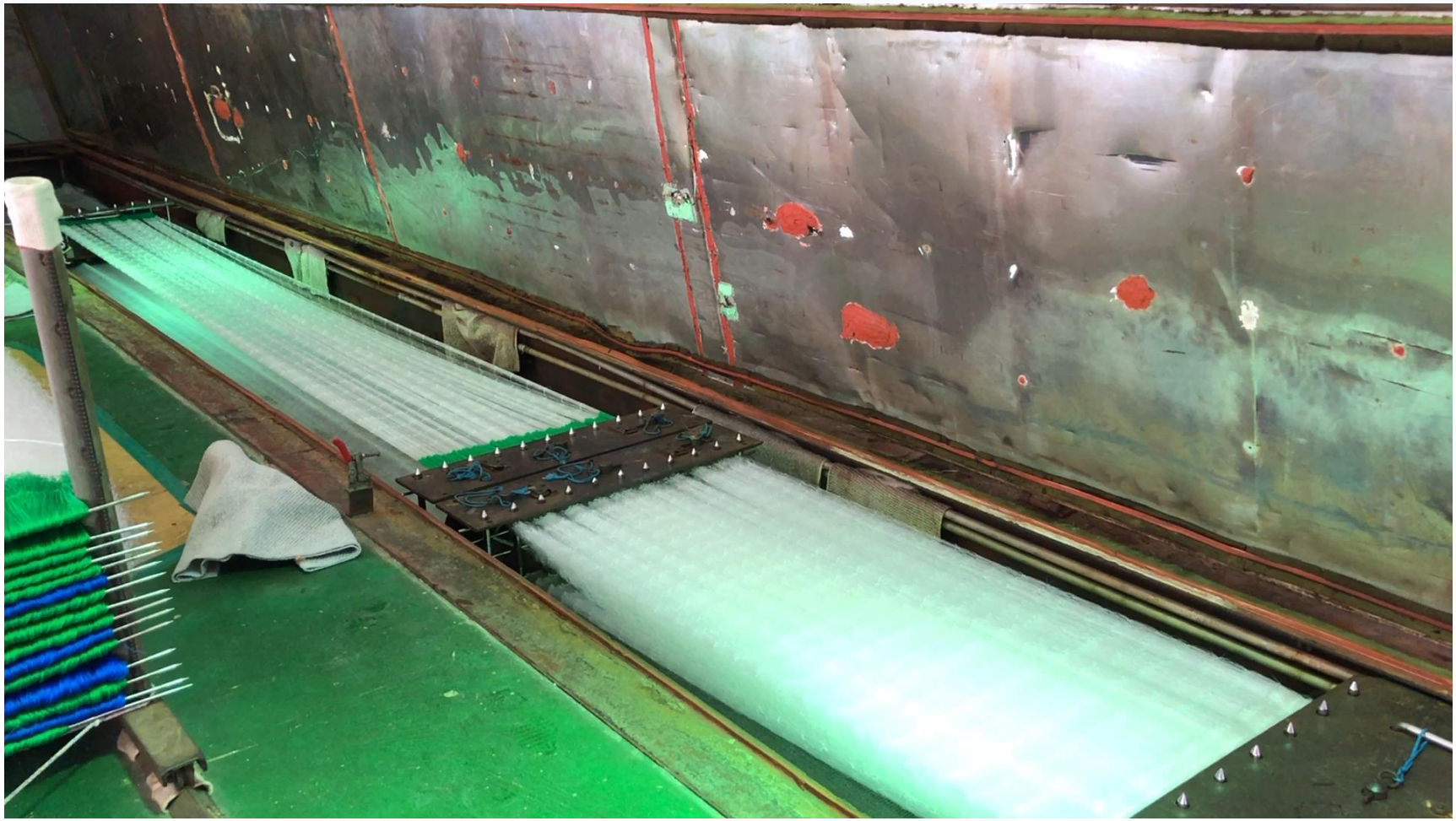



07 Research on improving biodegradable fishing net performance

Research on biodegradable net manufacturing process (seining and heat treatment)

07 Research on improving biodegradable fishing net performance

Research on biodegradable net manufacturing process (seining and heat treatment)



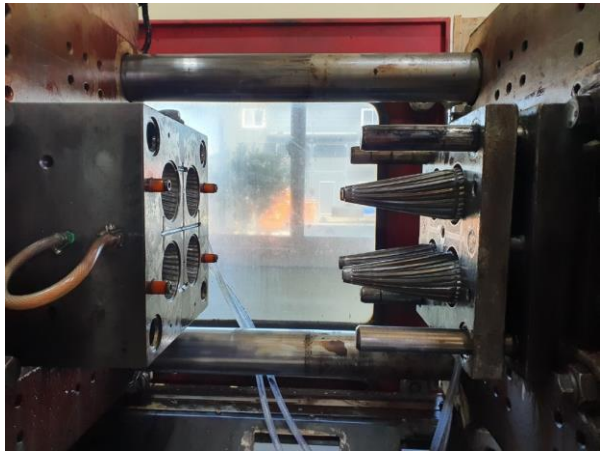
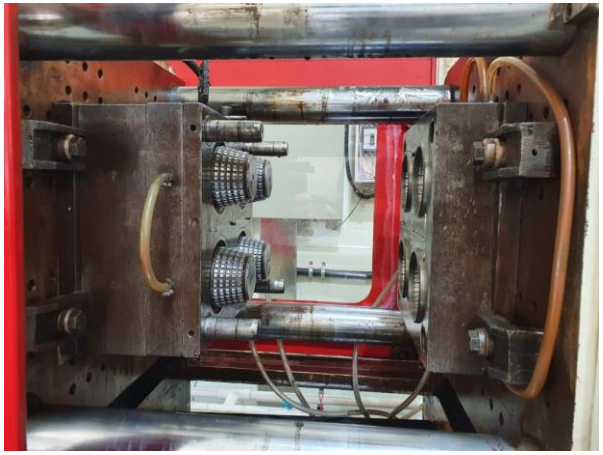
07 Research on improving biodegradable fishing net performance

Research on biodegradable net manufacturing process (seining and heat treatment)

07 Research on improving biodegradable fishing net performance

Research on biodegradable fishing net manufacturing process (sea eel funnel fish pot, webfoot octopus and artificial conch)




07 Research on improving biodegradable fishing net performance

Research on biodegradable netting and net characteristics

Physical Characteristics

Tensile strength, Elongation, Flexibility, etc.

Environmental Hazard Analysis

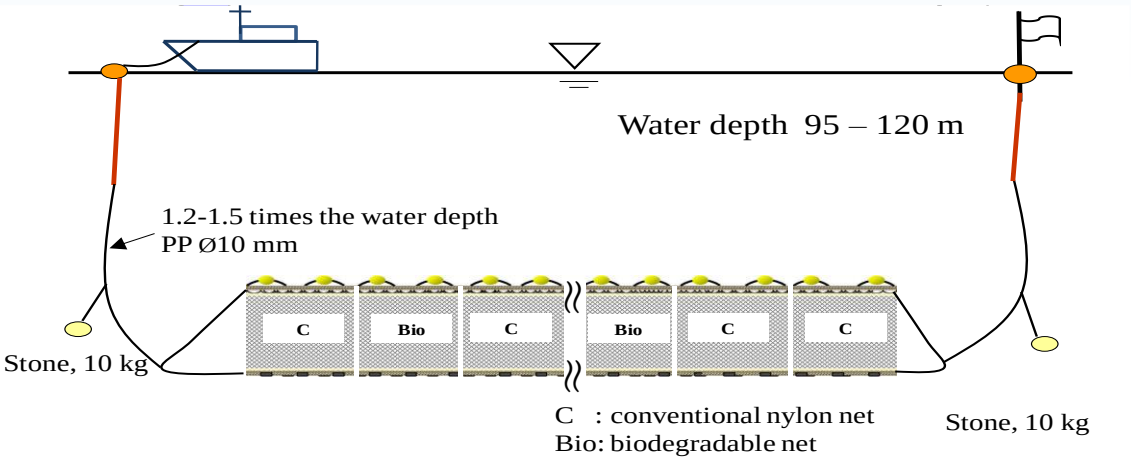
- Four heavy metals (Cadmium, Lead, Mercury, Chromium): RoHS (Restriction Of Hazardous Substances) Regulation safety testing , Certification standards for the management of hazard substances in electrical and electronic products used in Europe

- 197 types of hazardous substances: Reach (Registration, Evaluation, Authorization and Restriction of Chemicals) Regulation, EU mandates registration, assessment, authorization, and restriction for chemicals manufactured or imported in quantities of 1 ton or more annually, based on their hazard level and quantities

- Organotin compounds: KS K 0737 GC-MS, Heavy metal: EN71-3 ICP-OES

07 Research on improving biodegradable fishing net performance

Testing biodegradable fishing net performance (catching fish)



07 Research on improving biodegradable fishing net performance

Testing biodegradable fishing net performance (catching fish)





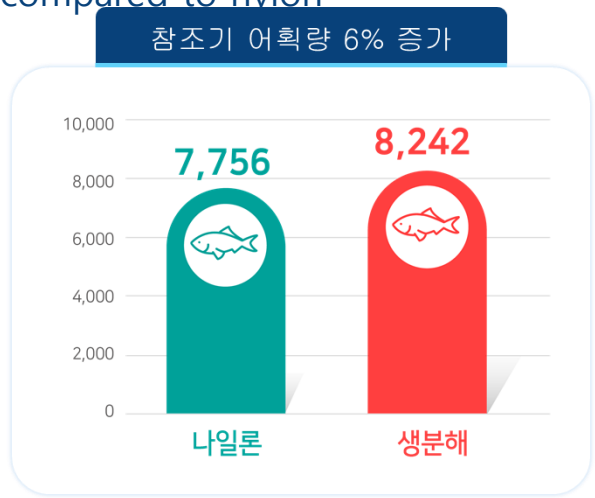
07 Research on improving biodegradable fishing net performance

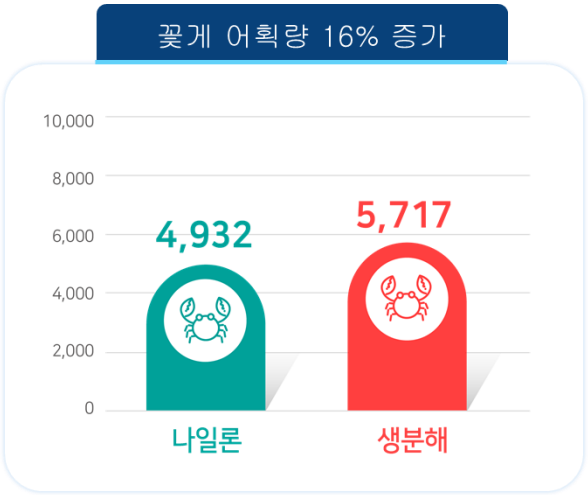
Development of high-quality biodegradable fishing net's material & netting (late 2020)

☑ **Material :** PBEAS

☑ Successful development of high- quality biodegradable nets with exceptional strength, elasticity, flexibility, and catching performance.

- **Strength**: Over 98% compared to nylon
- **Elasticity (Elongation):** 10% increase compared to nylon
- **Flexibility:** 20% increase compared to conventional material (PBS), 95% compared to nylon
- **Catching Performance:** (Small yellow croaker) 106% compared to nylon, (Swimming crab) 116% compared to nylon





07 Research on improving biodegradable fishing net performance

1 1~2년 후
그물 기능 상실

2 3~4년 후
물과 이산화탄소로
완전 분해

3 어획량, 나일론 그물보다
10% 증가

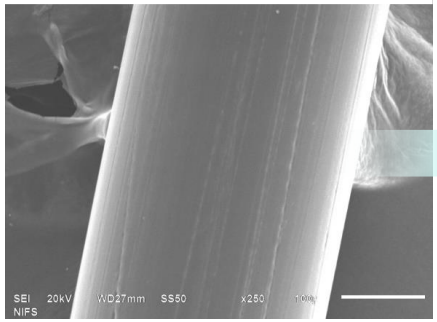
4 유연성 향상으로
물고기에도
사용가능

07 Research on improving biodegradable fishing net performance

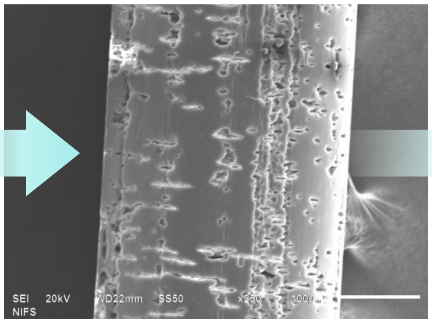
- ☑ After about one month, surface degradation will be assessed
- ☑ After about 3–4 years, it will be completely decomposed into water and carbon dioxide

CO_2 CO_2 CO_2

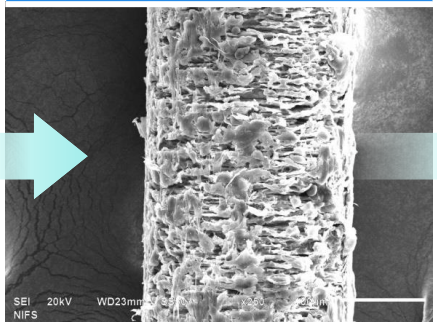
0 weeks



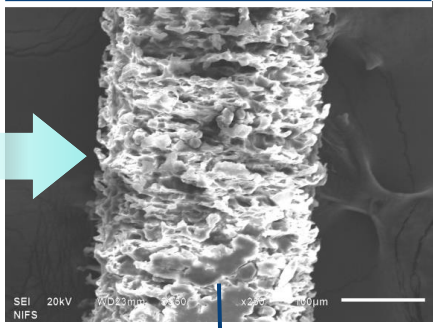
10 weeks



30 weeks

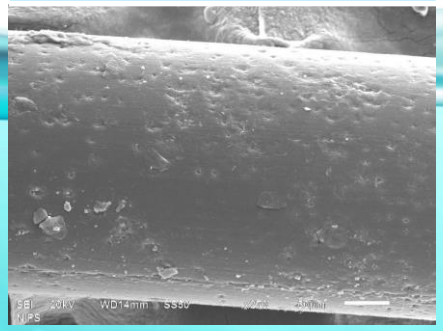


50 weeks



One year later

4 weeks



07 Research on improving biodegradable fishing net performance

☑ Biodegradable fishing net product standard establishment and implantation regarding synthesis, irradiation, seining net process and quality control standards for new material

08 Predictive research of biodegradable fishing net durability

2020–2024

Fisheries and Ocean Science Research Project

National Fisheries Research and Development Institute, research budget: 1.9 billion won

Predictive research of biodegradable fishing net's biodegradability control and durability for quality assurance

01 Correlation analysis based on environmental conditions (UV, salinity, temperature and humidity)

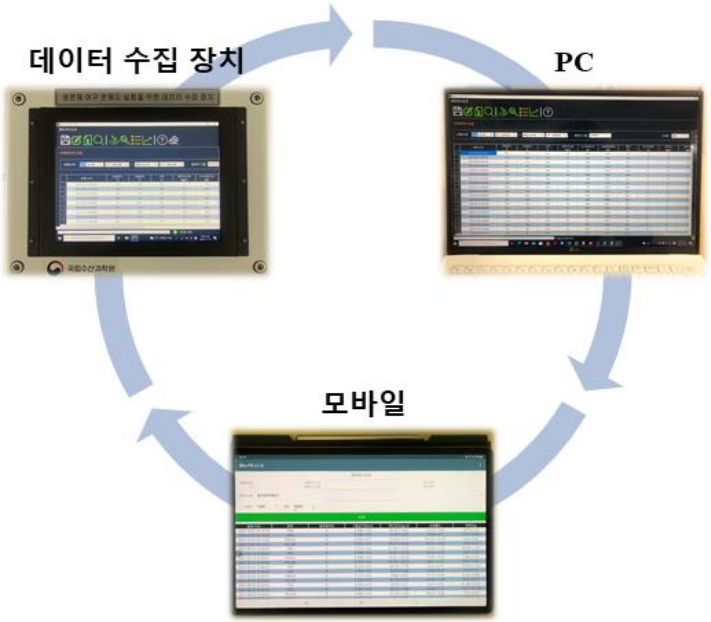
02 Predictive research of biodegradable fishing net's durability for actual users (fishermen)

03 Development of domestic standards (KS) for biodegradable fishing net decomposition testing

08 Predictive research of biodegradable fishing net durability

Establishment of database for comparative analysis of physical and chemical characteristics of biodegradable fishing nets

- Establishing a database server for storing and managing big data regarding biodegradable fishing net's physical and chemical characteristics.
- Enabling real time data sharing and enhancing user convenience through data integration across a collection of devices, PCs, and mobiles.



08 Predictive research of biodegradable fishing net durability

Biodegradable fishing net degradation according to marine submergence duration

☑ Biodegradable netting

- Experimental group: 2 types of biodegradable netting (PBS, PBEAS)
- Control group: 2 types of fiber netting (PA, PES)

☑ Biodegradable netting

- Experimental group: 2 types of biodegradable netting (PBS, PBEAS)
- Control group: 1 type of fiber netting (PA)

☑ Sea eel funnel fish pot

- Experimental group: 1 type of biodegradable funnel (PBS)
- Control group: 1 type of plastic funnel (PE)

08 Predictive research of biodegradable fishing net durability

Biodegradable fishing net degradation according to marine submergence duration

☑ Testing categories

- Environmental factors: Indoor temperature and humidity, water temperature, dissolved oxygen levels, pH, Oxidation-reduction potential, salinity, Ammonium, Nitrate, Nitrite, etc.
- Physical characteristics: Netting diameter, breaking strength, flexibility, surface damage, etc.
- Chemical characteristics: Weight average molecular weight, number average molecular weight, melting point, crystallization temperature, crystallinity, etc.

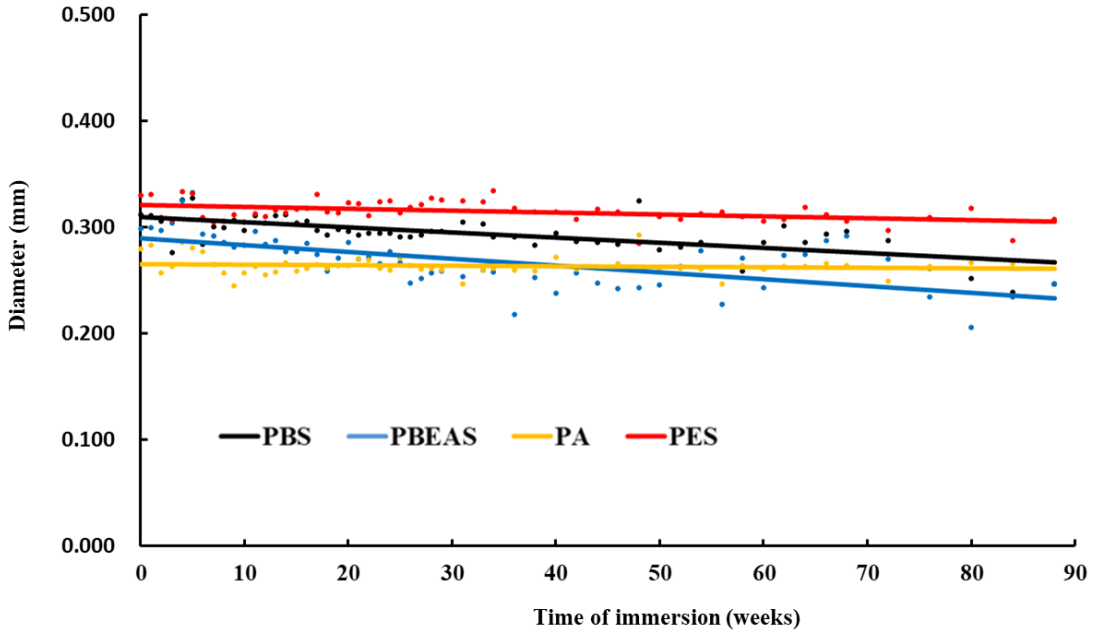
08 Predictive research of biodegradable fishing net durability

Biodegradable fishing net degradation according to marine submergence duration

☑ Netting physical characteristics analysis

- Netting diameter

• Analyzed up to the 88th week using an electron microscope and digital caliper.



[Changes in netting diameter over time of marine submergence]

PBS Netting

→ diameter down by 20.8%

PBEAS Netting

→ diameter down by 17.4%

PA Netting

→ diameter down by 4.6%

PES Netting

→ diameter down by 6.7%

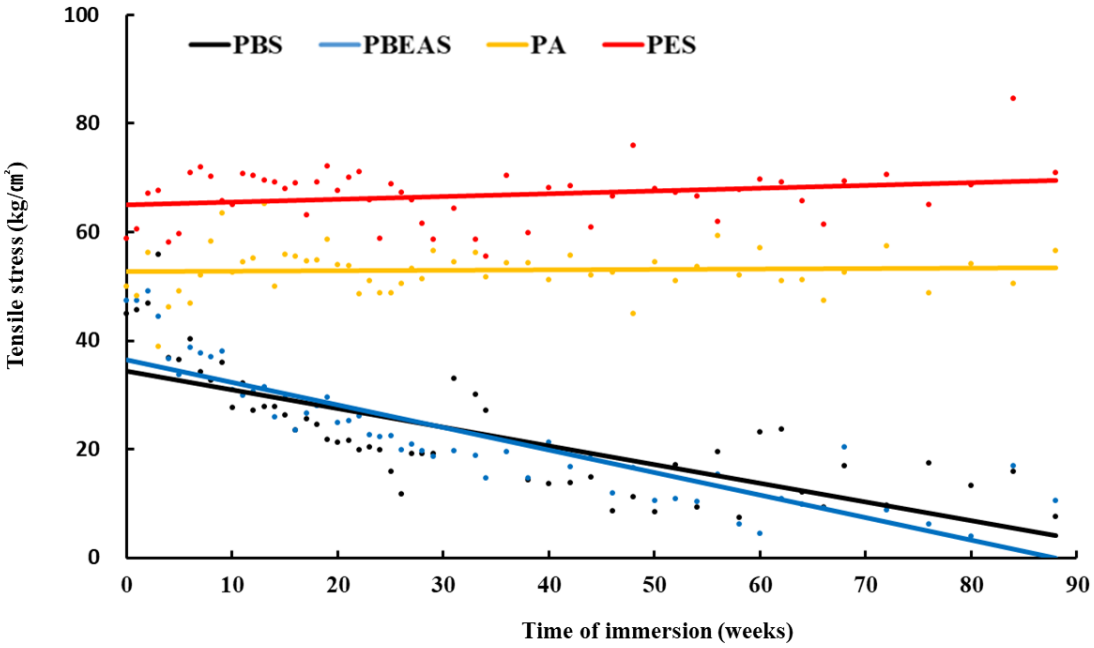
08 Predictive research of biodegradable fishing net durability

Biodegradable fishing net degradation according to marine submergence duration

☑ Netting physical characteristics analysis

- Breaking strength

• Analyzed up to the 88th week using a universal material testing machine



[Changes in netting braking strength over time of marine submergence]

PBS Netting

→ **breaking strength down by 83.0%**

PBEAS Netting

→ **breaking strength down by 77.8%**

PA Netting

→ breaking strength increased by 13.2%

PES Netting

→ breaking strength increased by 20.7%

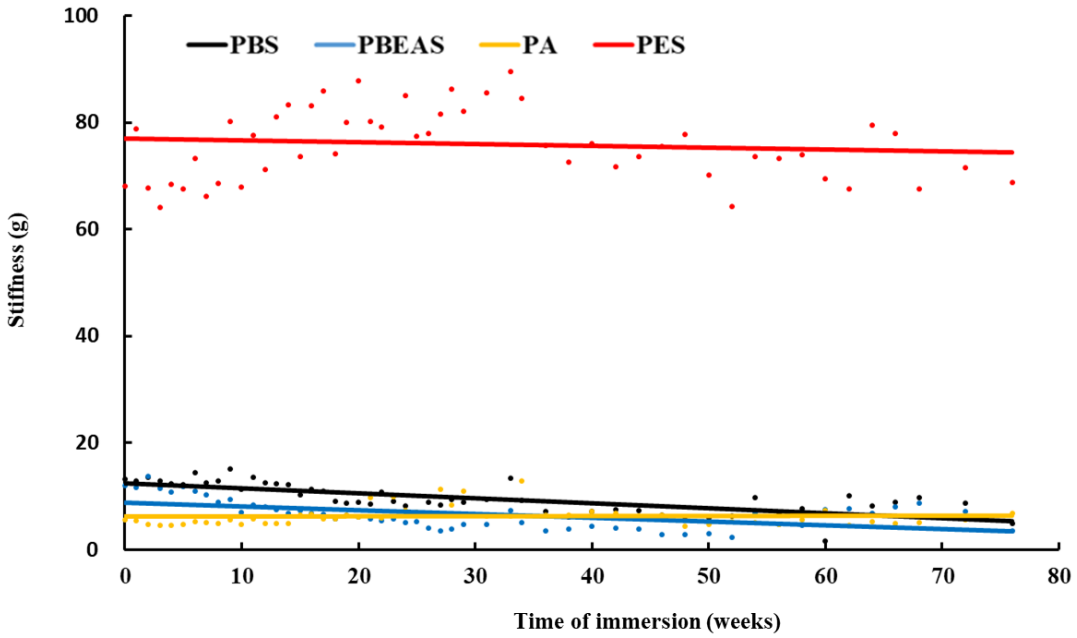
08 Predictive research of biodegradable fishing net durability

Biodegradable fishing net degradation according to marine submergence duration

☑ Netting physical characteristics analysis

- Flexibility

• Flexibility test was analyzed up to the 76th week.



[Changes in netting flexibility over time of marine submergence]

PBS Netting

→ **Flexibility increased by 62.4%**

PBEAS Netting

→ **Flexibility increased by 71.1%**

PA Netting

→ Flexibility down by 21.6%

PES Netting

→ Flexibility down by 1.2%

08 Predictive research of biodegradable fishing net durability

Biodegradable fishing net degradation according to marine submergence duration

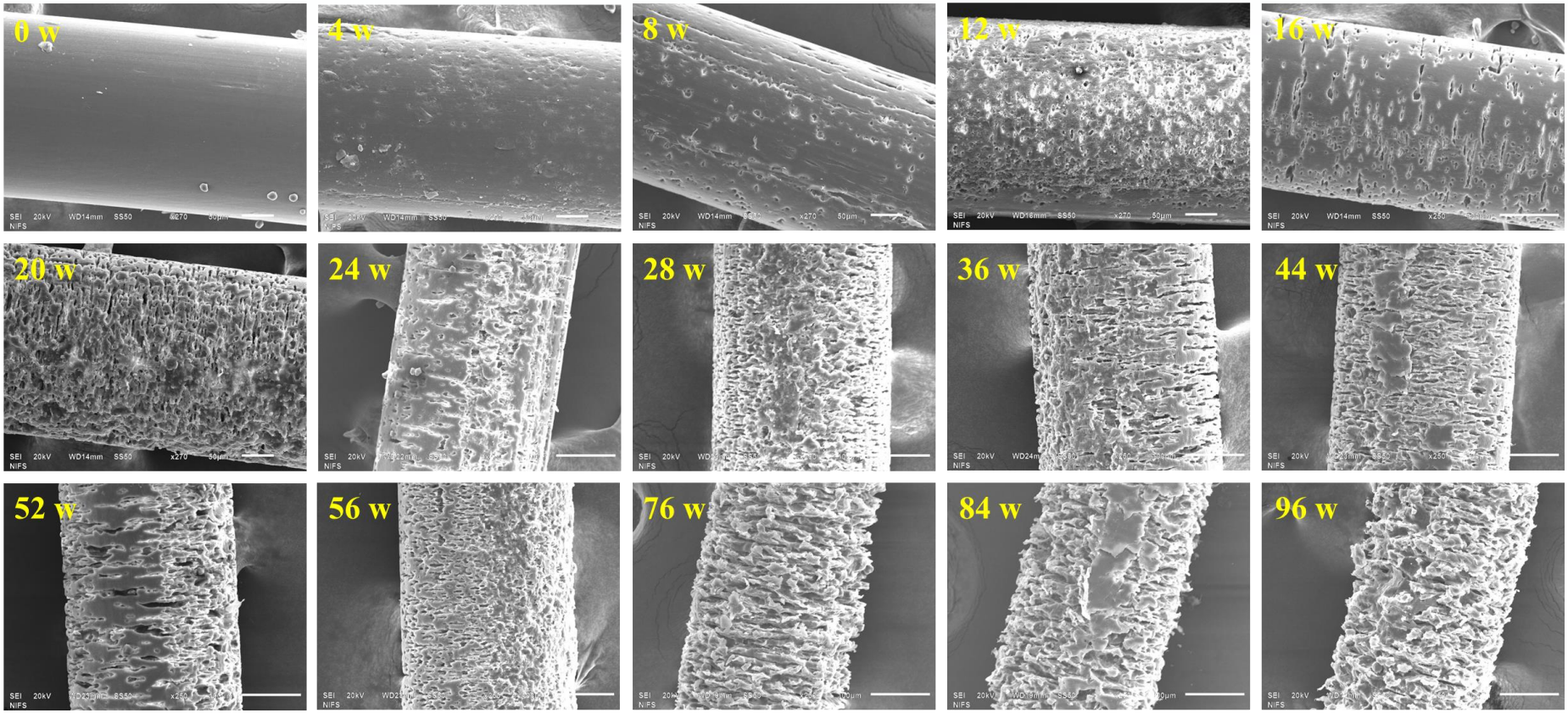
☑ Netting physical characteristics analysis

- Surface damage

- Analyzed up to the 96th week using a scanning electron microscope.

08 Predictive research of biodegradable fishing net durability

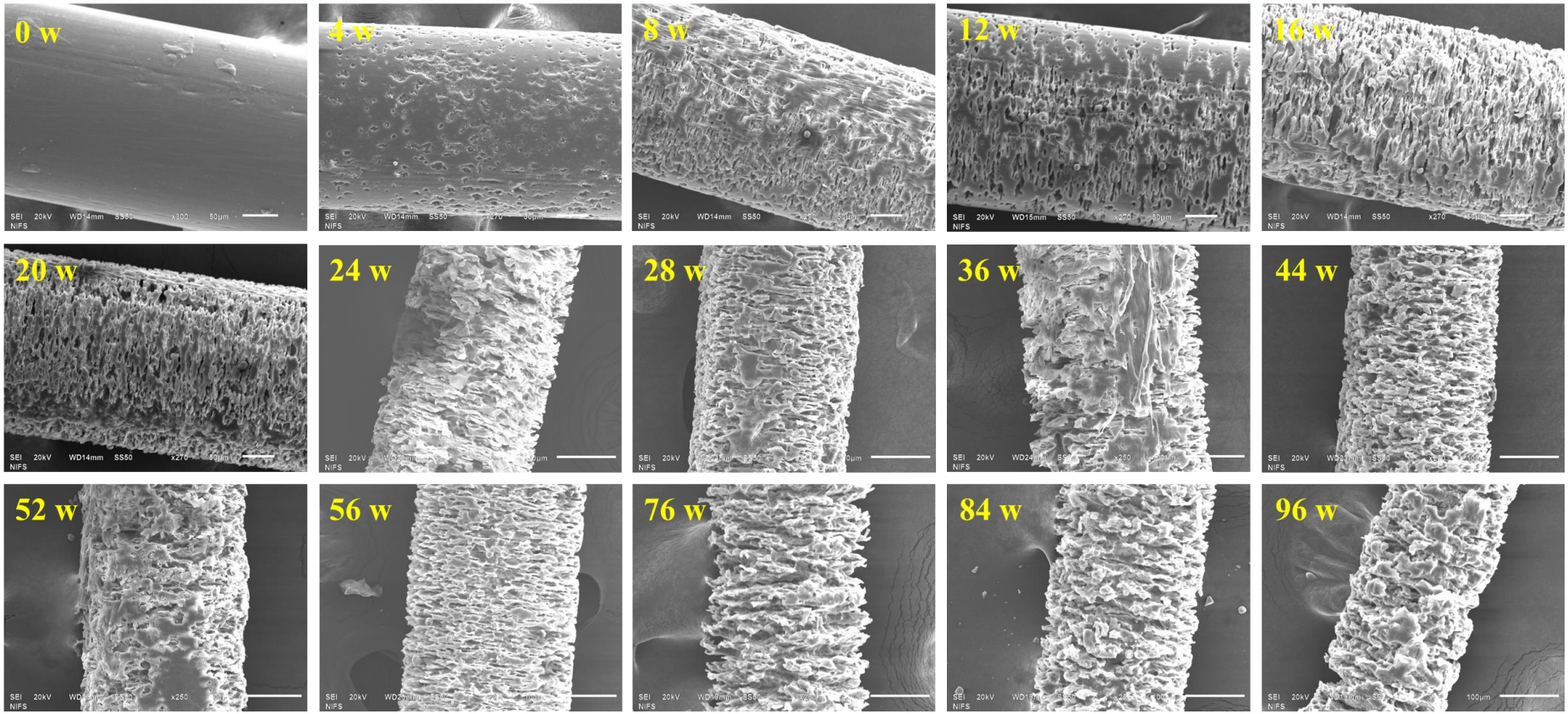
Biodegradable fishing net degradation according to marine submergence duration



[Changes in PBS netting surface damage over time of marine submergence]

08 Predictive research of biodegradable fishing net durability

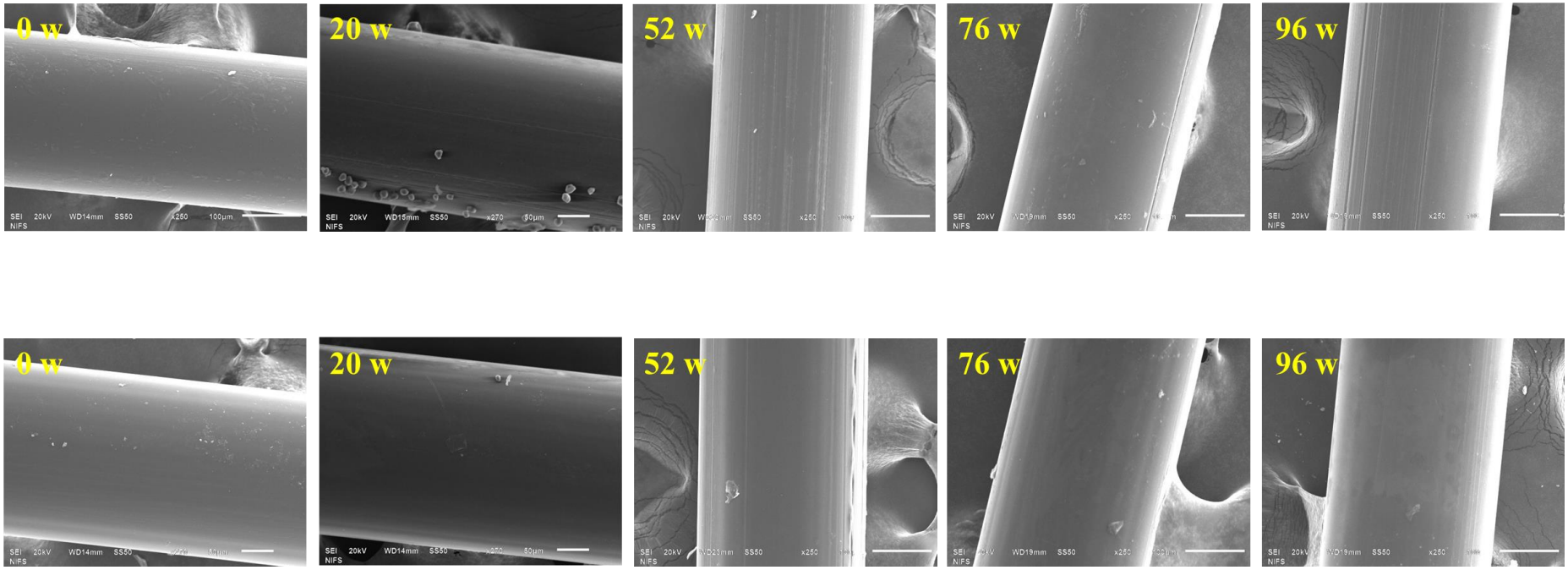
Biodegradable fishing net degradation according to marine submergence duration



[Changes in PBEAS netting surface damage over time of marine submergence]

08 Predictive research of biodegradable fishing net durability

Biodegradable fishing net degradation according to marine submergence duration



[Changes in PA (up), PES (down) netting surface damage over time of marine submergence]

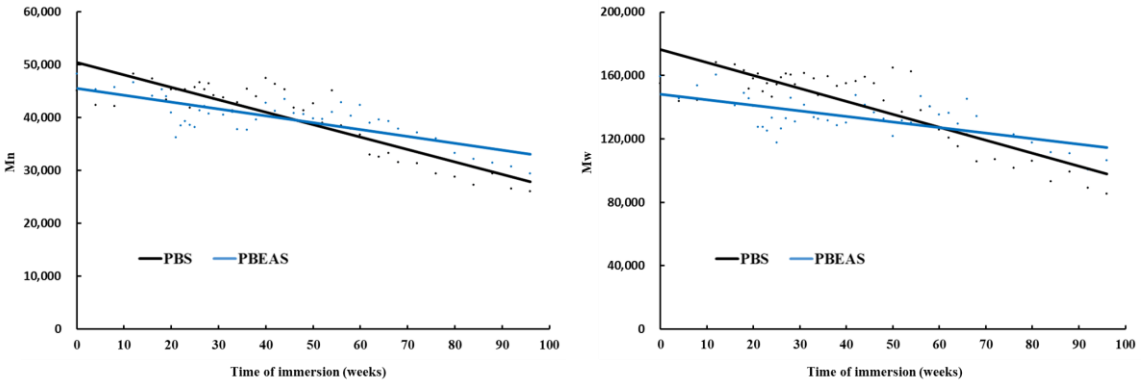
08 Predictive research of biodegradable fishing net durability

Biodegradable fishing net degradation according to marine submergence duration

☑ Netting chemical characteristics analysis

- Molecular weight (Number average molecular weight (M_n), Weight average molecular weight (M_w))

• Analyzed up to the 96th week using Gel Permeation Chromatography (GPC).



[Changes in biodegradable netting molecular weight over time of marine submergence]
((a) Number average molecular weight, (b) Weight average molecular weight)

PBS Netting

→ Number average molecular weight (M_n) down by 42.2%

→ Weight average molecular weight (M_w) down by 45.0%

PBEAS Netting

→ Number average molecular weight (M_n) down by 39.2%

→ Weight average molecular weight (M_w) down by 33.3%

08 Predictive research of biodegradable fishing net durability

Biodegradable fishing net degradation according to marine submergence duration

☑ Netting chemical characteristics analysis

- Melting point & crystallization temperature

• Analysis up to the 96th week using Differential Scanning Calorimetry (DSC) results

• Melting point: Almost no changes in the four types of netting (PBS, PBEAS, PA, PES)

• Crystallization temperature: As the biodegradable PBS and PBEAS netting underwent degradation, crystallization tended to occur. Although the temperature decreased, there was little change in the crystallization temperature for PA and PES netting.

- Crystallinity

• Analysis up to the 96th week using Fourier Transform Infrared Spectroscopy (FT-IR) results

• Crystallinity: Almost no changes in components among the four types of netting (PBS, PBEAS, PA, PES)

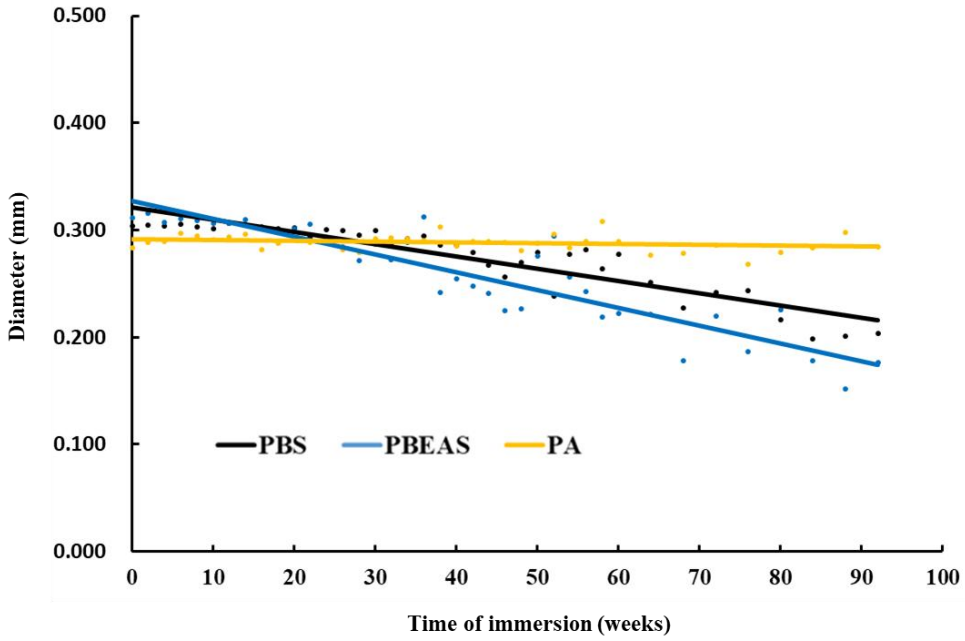
08 Predictive research of biodegradable fishing net durability

Biodegradable fishing net degradation according to marine submergence duration

☑ Netting physical characteristics analysis

- Netting diameter

• Analyzed up to the 92th week using an electron microscope and digital caliper.



[Changes in netting diameter over time of marine submergence]

PBS Netting

→ diameter down by 33.0%

PBEAS Netting

→ diameter down by 43.4%

PA Netting

→ Almost no changes in diameter

08 Predictive research of biodegradable fishing net durability

Biodegradable fishing net degradation according to marine submergence duration

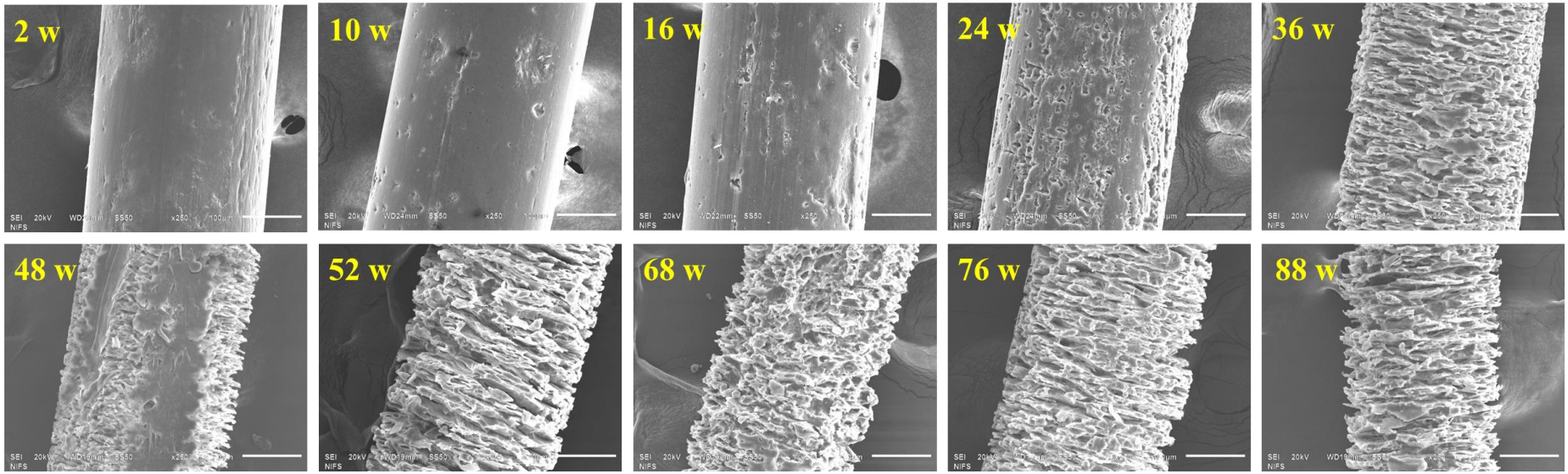
☑ Netting physical characteristics analysis

- Surface damage

- Analyzed up to the 88th week using a scanning electron microscope.

08 Predictive research of biodegradable fishing net durability

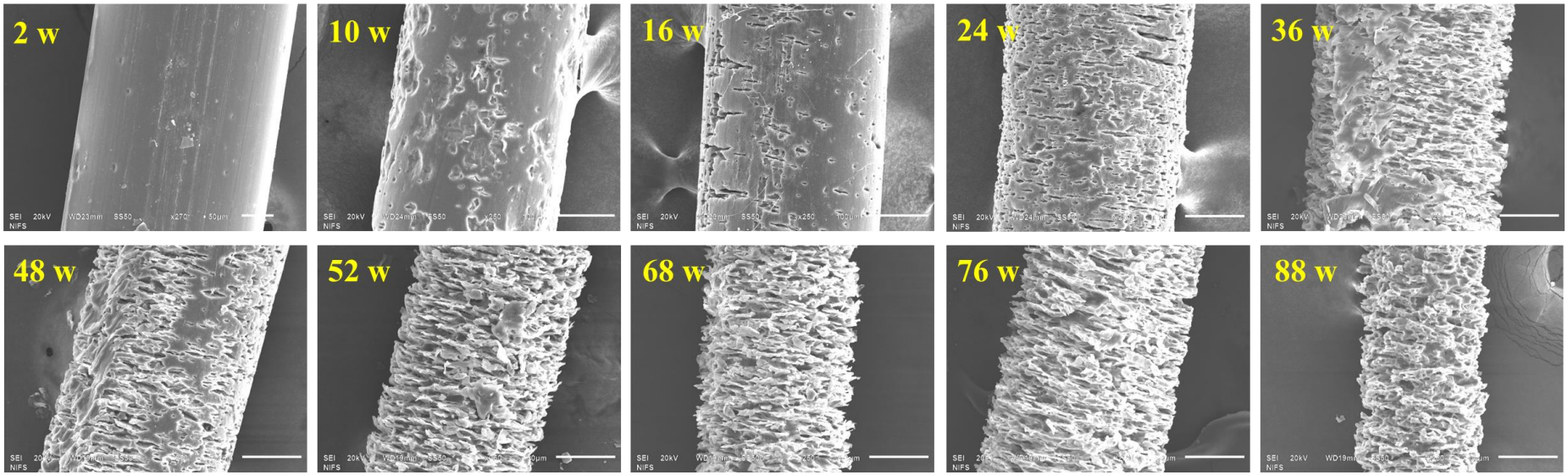
Biodegradable fishing net degradation according to marine submergence duration



[Changes in PBS netting surface damage over time of marine submergence]

08 Predictive research of biodegradable fishing net durability

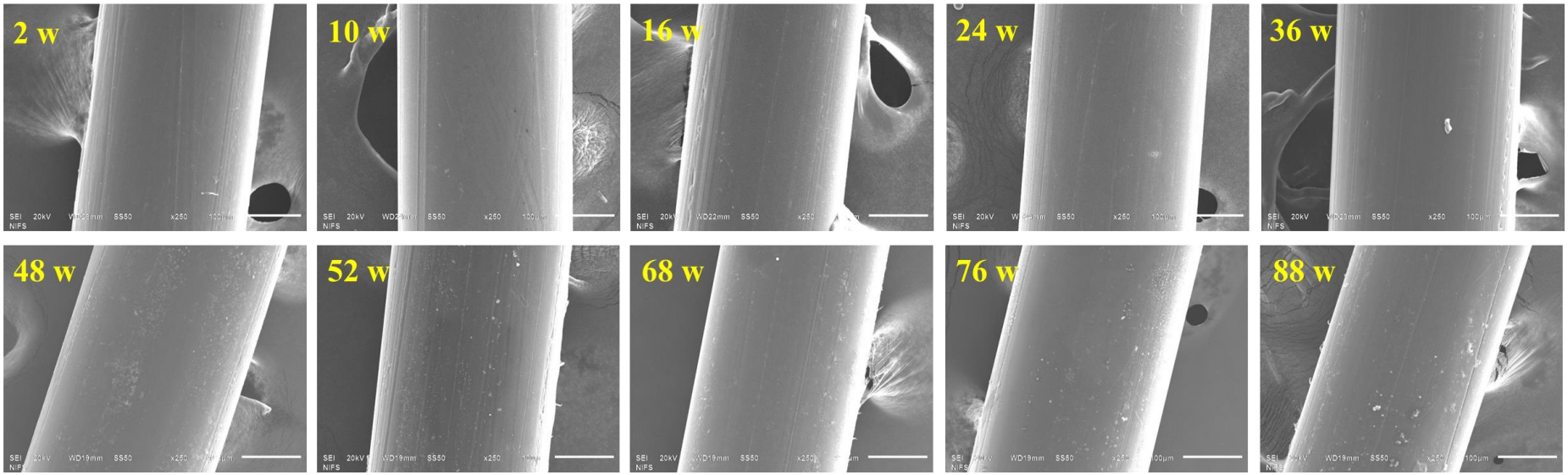
Biodegradable fishing net degradation according to marine submergence duration



[Changes in PBEAS netting surface damage over time of marine submergence]

08 Predictive research of biodegradable fishing net durability

Biodegradable fishing net degradation according to marine submergence duration



[Changes in PA netting surface damage over time of marine submergence]

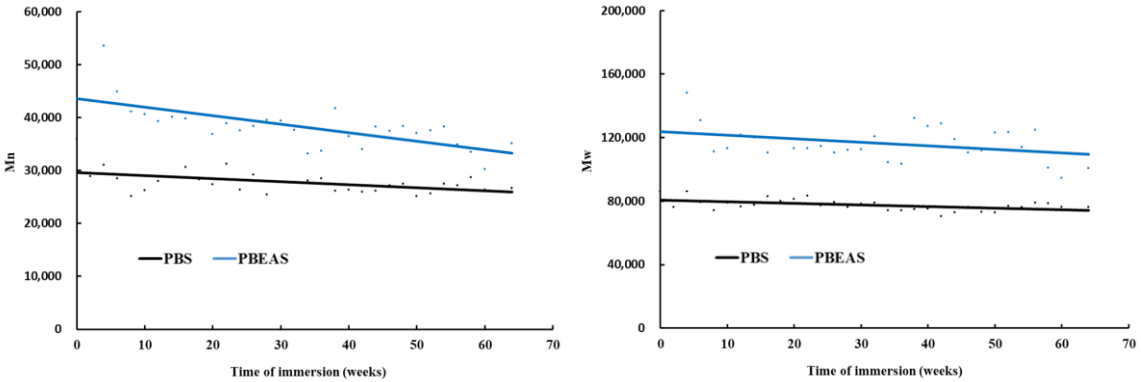
08 Predictive research of biodegradable fishing net durability

Biodegradable fishing net degradation according to marine submergence duration

☑ Netting chemical characteristics analysis

- Molecular weight (Number average molecular weight (M_n), Weight average molecular weight (M_w))

• Analyzed up to the 64th week using Gel Permeation Chromatography (GPC).



[Changes in biodegradable netting molecular weight over time of marine submergence]
((a) Number average molecular weight, (b) Weight average molecular weight)

PBS 그물

→ Number average molecular weight (M_n) down by 25.9%

→ Weight average molecular weight (M_w) down by 11.8%

PBEAS Netting

→ Number average molecular weight (M_n) down by 34.4%

→ Weight average molecular weight (M_w) down by 32.0%

08 Predictive research of biodegradable fishing net durability

Biodegradable fishing net degradation according to marine submergence duration

☑ Netting chemical characteristics analysis

- Melting point & crystallization temperature

• Analysis up to the 64th week using Differential Scanning Calorimetry (DSC) results

• Melting point: Almost no changes in the three types of netting (PBS, PBEAS, PA)

• Crystallization temperature: As the biodegradable PBS and PBEAS netting underwent degradation, crystallization tended to occur. Although the temperature decreased, there was little change in the crystallization temperature for PA netting.

- Crystallinity

• Analysis up to the 64th week using Fourier Transform Infrared Spectroscopy (FT-IR) results

• Crystallinity: Almost no changes in components among the three types of netting (PBS, PBEAS, PA)

08 Predictive research of biodegradable fishing net durability

Biodegradable fishing net degradation according to marine submergence duration

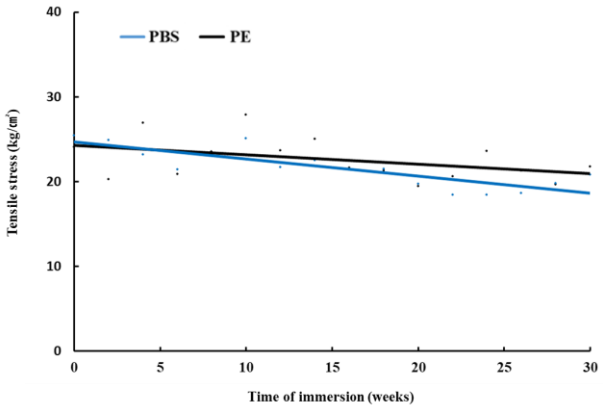
☑ Sea eel funnel fish pot physical characteristics analysis

- Funnel weight

- Analyzed up to the 30th week using an electronic scale result
- Weight: Almost no changes in the two types of funnel (PBS, PE)

- Breaking strength

- Analyzed up to the 30th week using a universal material testing machine.



PBS funnel

→ breaking strength down by 18.1%

PE funnel

→ breaking strength down by 9.5%

[Changes in funnel breaking strength over time of marine submergence]

08 Predictive research of biodegradable fishing net durability

Biodegradable fishing net degradation according to marine submergence duration

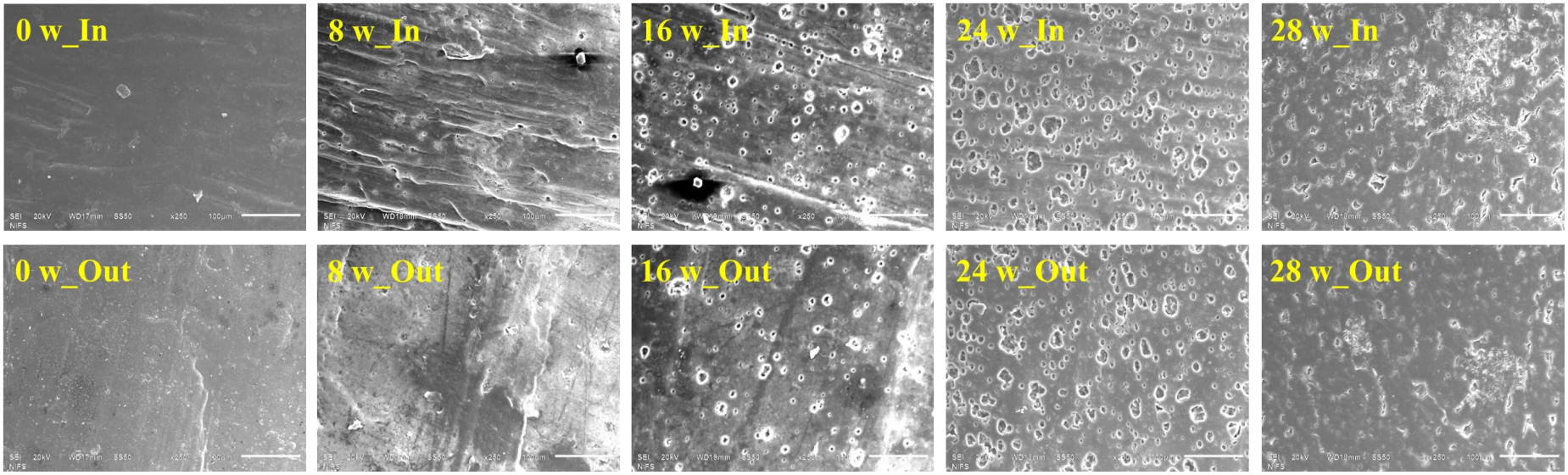
☑ Sea eel funnel fish pot physical characteristics analysis

- Surface damage

- Analyzed up to the 30th week using a scanning electron microscope.

08 Predictive research of biodegradable fishing net durability

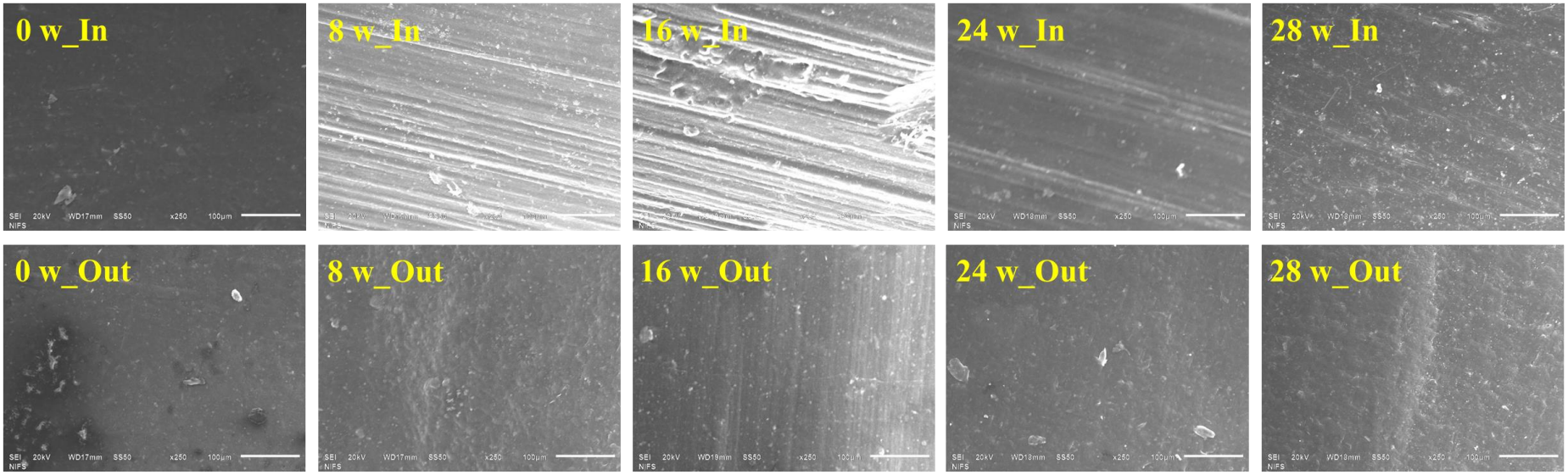
Biodegradable fishing net degradation according to marine submergence duration



[Changes in PBS funnel surface over time of marine submergence]

08 Predictive research of biodegradable fishing net durability

Biodegradable fishing net degradation according to marine submergence duration



[Changes in PE funnel surface over time of marine submergence]

08 Predictive research of biodegradable fishing net durability

Biodegradable fishing net degradation according to marine submergence duration

☑ Sea eel funnel fish pot chemical characteristics analysis

- Molecular weight (Number average molecular weight (M_n), Weight average molecular weight (M_w))

- Analyzed up to the 8th week using Gel Permeation Chromatography (GPC).
- Molecular weight: Almost no changes in the two types of funnel (PBS, PE)

- Melting point & crystallization temperature

- Analysis up to the 8th week using Differential Scanning Calorimetry (DSC) results,
- Melting point: Almost no changes in the two types of funnel (PBS, PE)
- Crystallization temperature: Almost no changes in the two types of funnel (PBS, PE)

- Crystallinity

- Analysis up to the 8th week using Fourier Transform Infrared Spectroscopy (FT-IR) results,
- Crystallinity: Almost no changes in the two types of funnel (PBS, PE)

08 Predictive research of biodegradable fishing net durability

Research on the effectiveness of vacuum packaging for long term storage of biodegradable fishing nets

☑ Biodegradable netting

- Experimental group: Currently, three types of biodegradable nets (crab, swimming crab, small yellow croaker gillnets) are being distributed in vacuum-sealed packaging.
- Control group: Currently, three types of biodegradable nets (crab, swimming crab, small yellow croaker gillnets) are being distributed in normal packaging.

09 Biodegradable fishing net's environmental impact and technological advancement research

Research on biodegradable fishing net's toxicity assessment

- ☑ Research on the detection of heavy metals and hazardous substances in microplastics generated by biodegradable fishing net degradation
- ☑ Testing and assessment of marine and fish impact due to microplastics from biodegradable fishing net degradation

Research on testing techniques related to biodegradable fishing net

- ☑ Development of Domestic Standards (KS) for testing methods of marine and fish impact due to microplastics from biodegradable fishing net degradation

10 Globalization of biodegradable fishing nets

International presentation of research achievements (paper and patents)

- ☑ Submission of paper to fisheries technology (ICES journal, fisheries research, fisheries science) and polymer related journals
- ☑ Seeking patents for biodegradable fishing net material composition and net manufacturing methods in various countries (China, Vietnam, EU)

Promotion through international organizations and conferences

- ☑ Promotion through international organizations and relevant conferences such as FAO and the UN

Biodegradable netting & exporting netting

- ☑ Registration of product names for biodegradable fishing nets
- ☑ Export or ODA efforts to Kuwait, USA, India, Indonesia, etc.

11 Environmental friendly (biodegradable) fishing gear distribution project

Project Overview

Goal

- In order to prevent contamination of the marine environment and mitigate damage caused by discarded fishing nets, support should be provided for the distribution of biodegradable fishing nets that can naturally decompose underwater.

Relevant statutory provisions

- Fishery Resources Management Act Article 27 (Use of environmentally friendly gear)
- Enforcement Decree of the Fishery Resources Management Act Article15 (Expansion of development and use of environmentally friendly gear)

Performance goal & index

Result Index	2023 Goal	5 years of performance					Timing of Indicator Calculation	Measurement Method
		'18	'19	'20	'21	'22		
Biodegradable fishing gear distribution performance Actual Implementation Rate(%)	90.0	60.4	49.5	36.9	88.6	90 (Estimated)	연말	(Expenditure/Budget Amount)×100

Annual Budget Allocation Plan

(unit: million won)

Category	2021	2022	2023	2024
Total	7,428	7,428	8,428	10,000
National / Local Funding	5,200 / 2,228	5,200 / 2,228	5,900 / 2,528	7,000 / 3,000

11 Environmental friendly (biodegradable) fishing gear distribution project

Biodegradable fishing gear development items

☑ 15 types of gillnets, 6 types of funnel fishing pots, and 3 other gears etc. (total of 24 types)

- King crab, small yellow croaker, red king crab, three spot swimming crab, silver pomfret, pacific cod, east sea flounder, okhotsk atka macerel, pacific herring, red sea-bream, south coast flounder, black porgy, single swimming crab gillnet, yellow corvina trap, flounder gillnet
- Shrimp, red king crab, swimming crab, small octopus, sea snail, swimming crab funnel fish pot
- Sea eel plastic funnel fish pot, octopus trap, webfoot octopus and artificial conch

Distributed items for 2023

☑ 6 types of gillnets, 3 types of funnel fish pots, and one gear etc. (total of 9 types)

- King crab, red king crab, small yellow croaker, swimming crab, flounder, seabream cage
- Octopus, sea snail, swimming crab funnel fish pot
- Sea eel funnel fish pot

Thank you