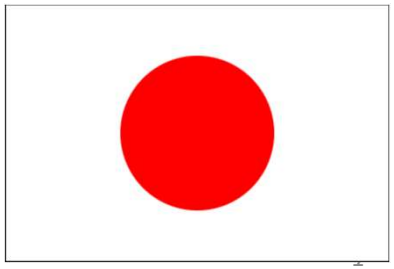
Possible Countermeasure against Forest Fire
- Effectiveness of Class A Foam -

Shabondama Soap Co., Ltd.
Takayoshi Kawahara



1. Company introduction
2. Features and countermeasures for Forest fires
3. Mechanism of fire extinguishing with firefighting foam
4. Features of Soap-based Class A Foam
5. Actual use of soap-based firefighting foam

1. Company introduction

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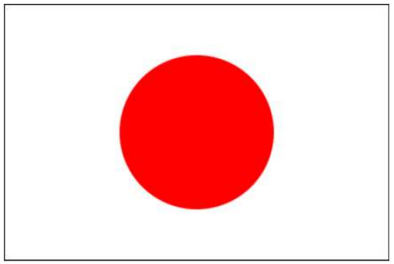
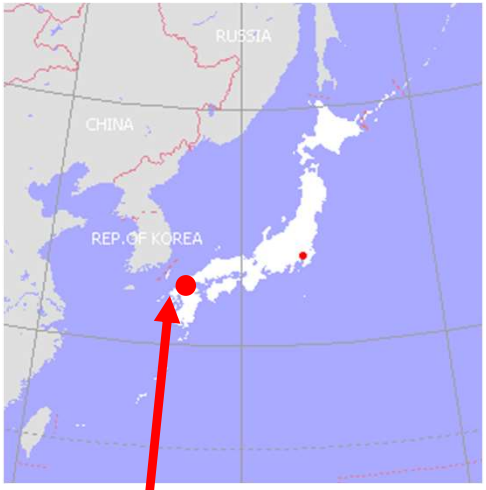


Company introduction

Corporate Vision：Protect healthy body and clean water



Head office: Kitakyushu city, Fukuoka Prefecture
Establishment: 1910
Sales: 8.9 billion yen
Capital: 100 million yen

<Manufacturing Products>
Additive-free soap
Shampoo, conditioner
Toothpaste
Bleach・baking soda
Fire fighting agent

Corporate History

1910 Established business as a soap wholesale “Morita Hanjiro Store”

1961 Started a sale of a new detergent product

1971 Consulted from the State-run railway company (present, JR Kyushu) for manufacturing additive-free soap for washing the locomotive train to avoid rust

1972 Succeeded to develop additive-free soap (authorized by Japan Industrial Standard: JIS)

This additive-free soap cured the long suffering skin eczema

1973 Completely stopped the production of detergent and changed to additive-free soap

Positive Cycle of 3 Pillars of Shabondama

Society

Seeking a Solution for Skin Problem

Economy

Attracting Consumer through Corporate Brand

Environment

Developing Products that is Friendly to People and Environment

Corporate vision “Protect healthy body and clean water” is formed through integration of society, environment, and economy

2. Features and countermeasures for Forest fires

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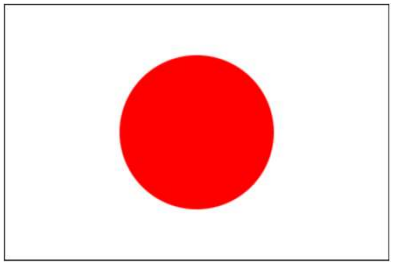
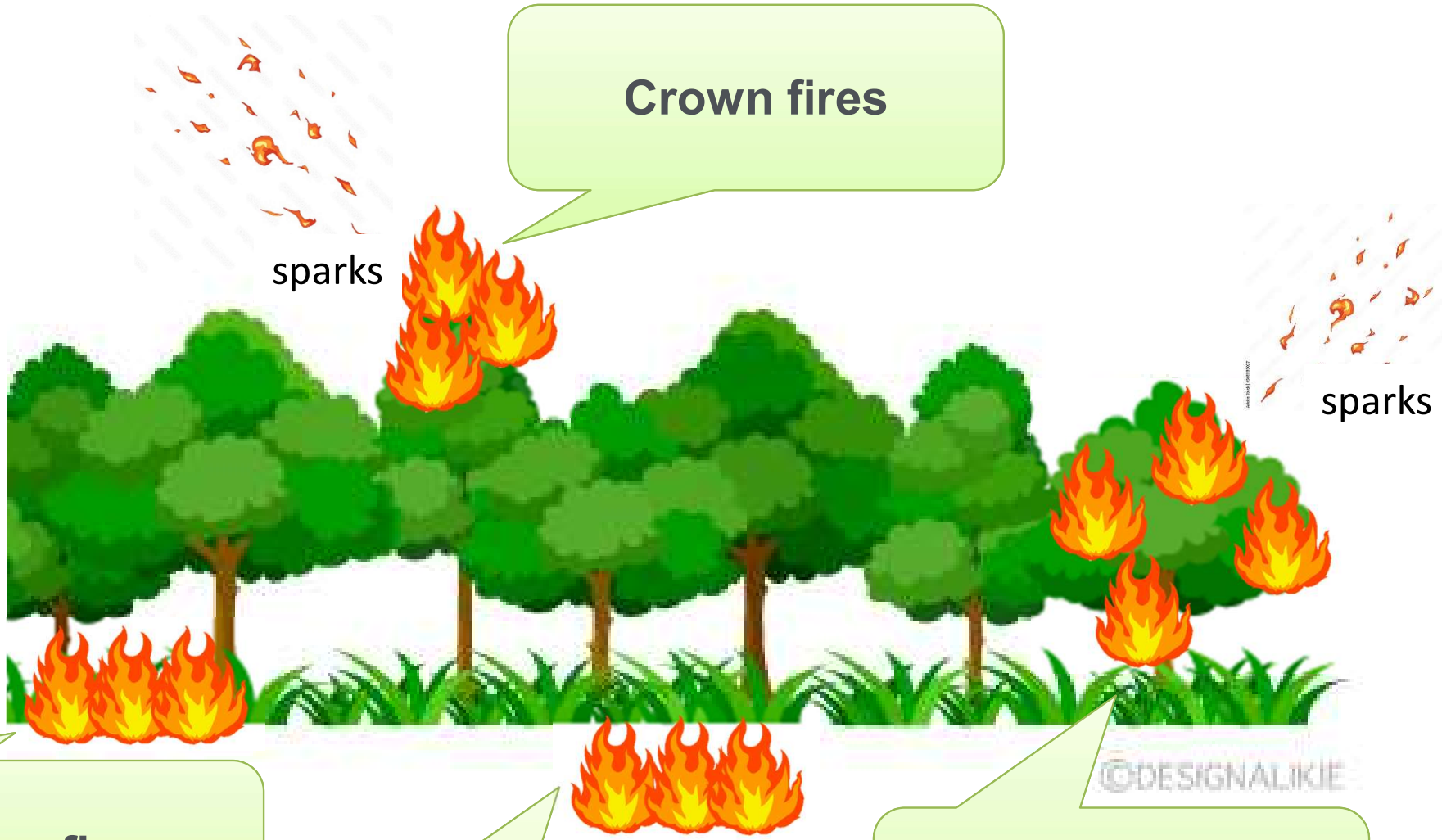


Forest fires

About Forest fires

4 types



About Forest fires

Factors affecting the spread of forest fires

Wind

Dry area

slope land

flammable material

Sparks

About Forest fires

Forest Fire Hazard Factors

Amount of combustible materials

Eutrophic Plants and Trees

Amount of flammable combustible materials up to 2 m from the ground

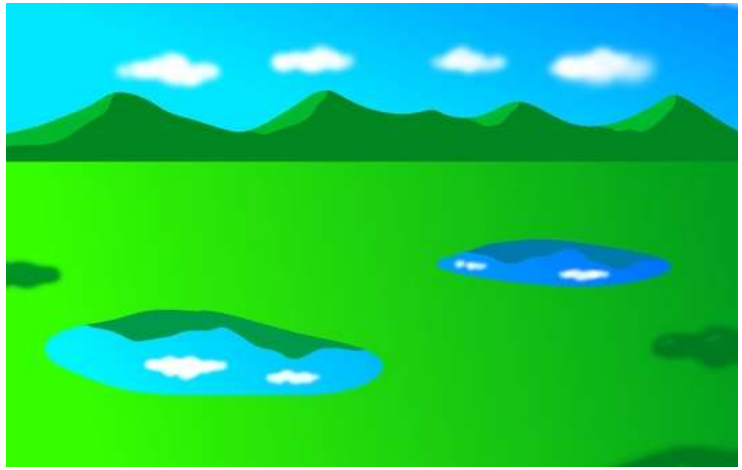
High hazard locations with forest fires

- ✓ Deciduous broadleaf forest on summit and ridge
- ✓ Red pine forest on the summit and ridge
- ✓ Areas where silver grass and other trees have died in logging areas
- ✓ Red pine forests with deciduous broad-leaved trees as shrubs
- ✓ Miscanthus sinensis grassland on flat areas

Countermeasures for Forest fires

Management of forest

Guard



Water supply

Efficient firefighting

Use of firefighting agent is effective!

3. Mechanism of fire extinguishing with firefighting foam

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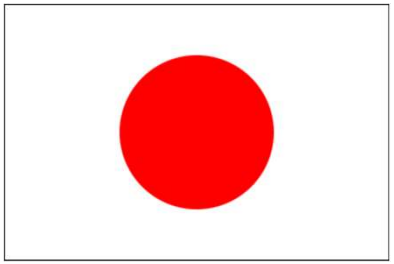


Three elements of combustion

combustible

remove

Water

heat

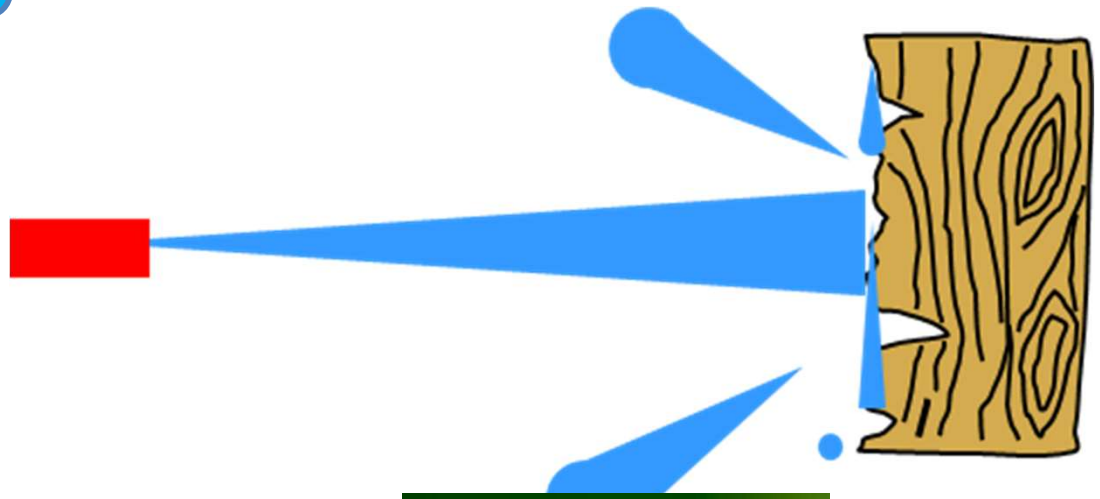
Oxygen

Cooling

Cut off the air

Fire extinguishing

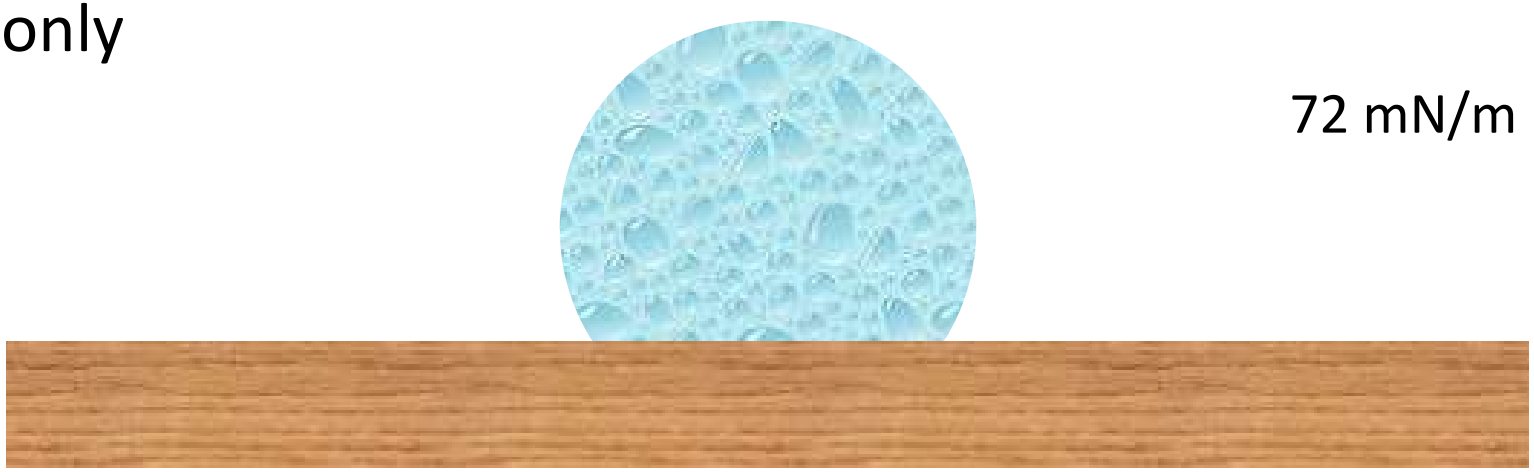
Water: high effective for cooling



Surface tension

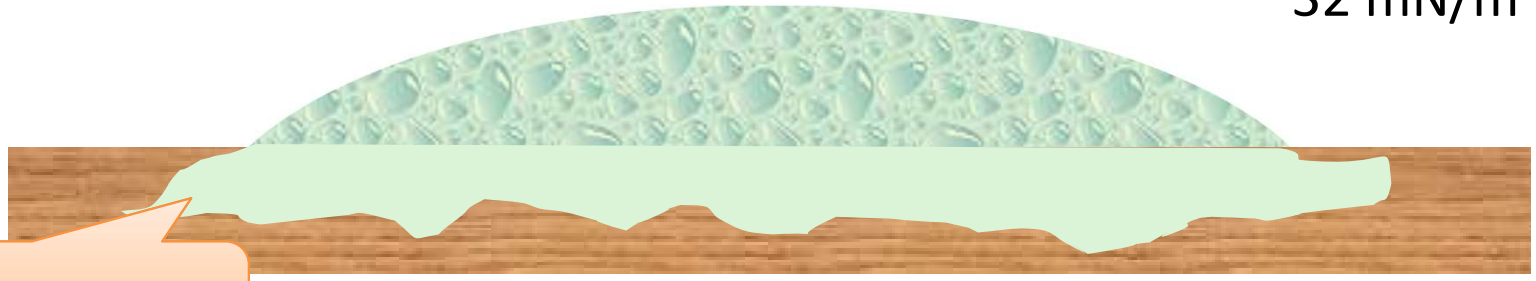
Surface tension

Water only



72 mN/m

Water containing Firefighting foam



32 mN/m

penetration

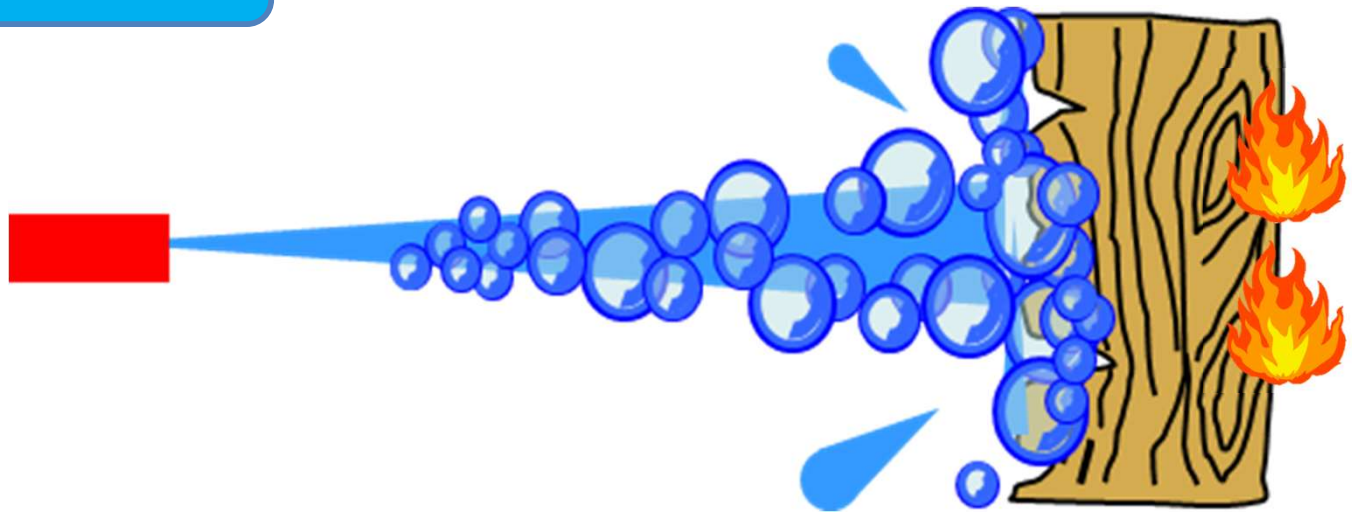
Effective for firefighting foam

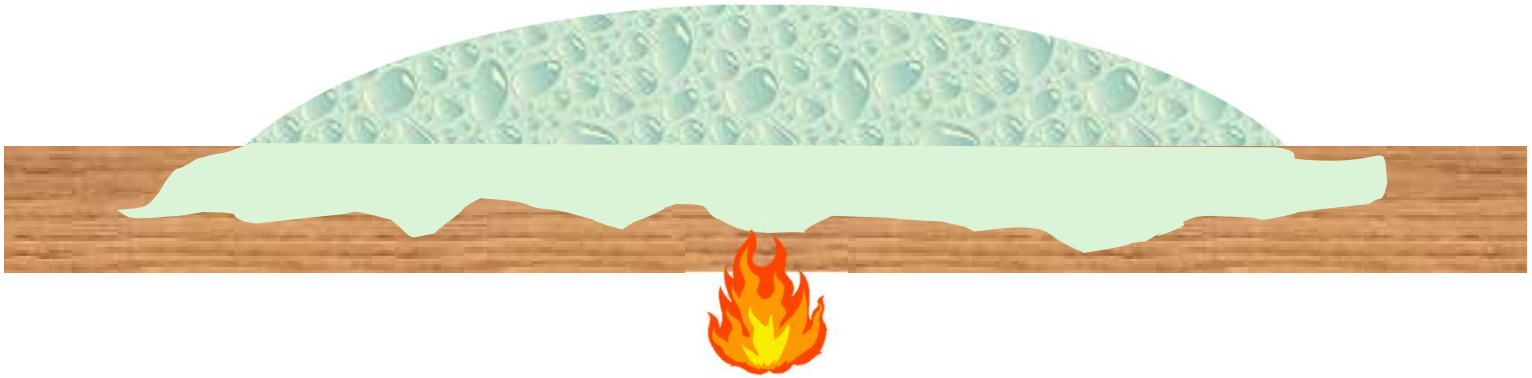
Water: high effective for cooling

+

Stickness

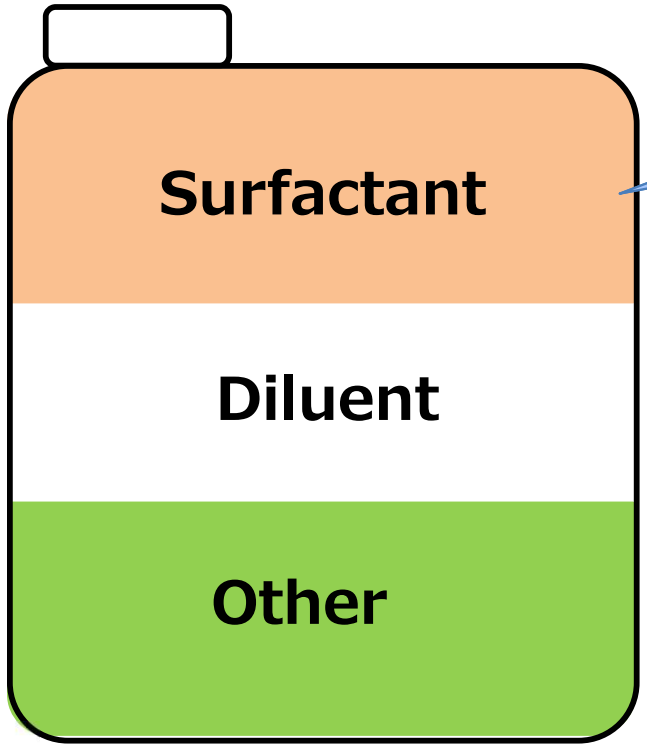
wettability



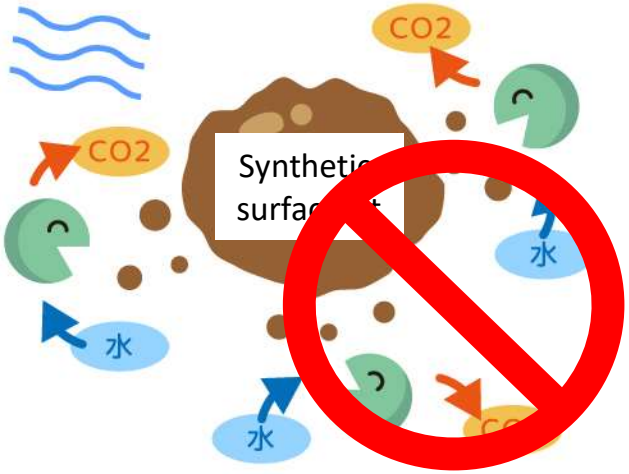


About firefighting foam

Synthetic surfactant

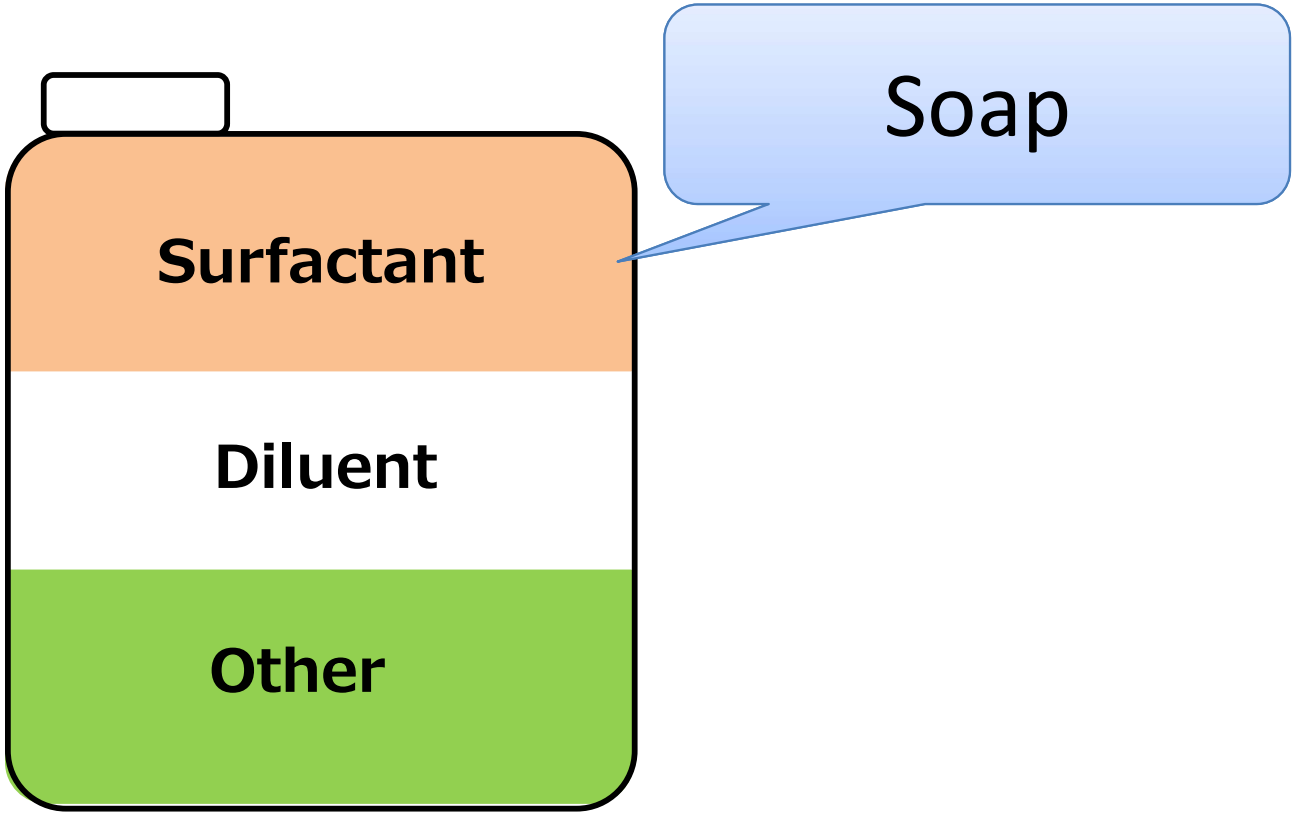


toxicity

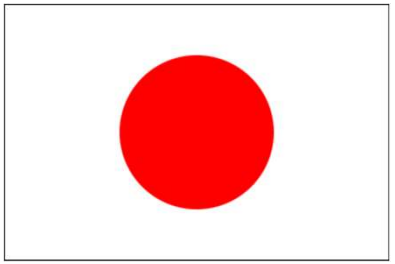


Hard to be decomposed

New Proposal of firefighting foam



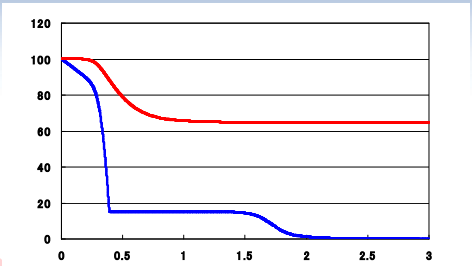
4. Features of Soap-based Class A Foam



About soap

100%

Biodegradation



Growth test for plants

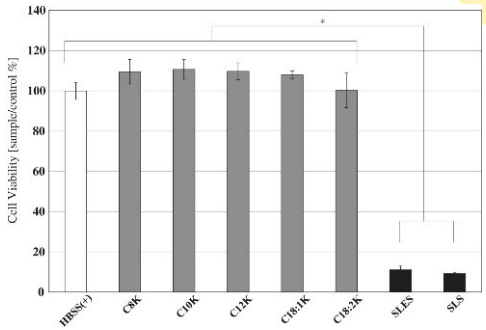
Vision

"Protect healthy body and clean water"

Low toxicity to plant

Low toxicity to life in water

Low stimulus to human skin

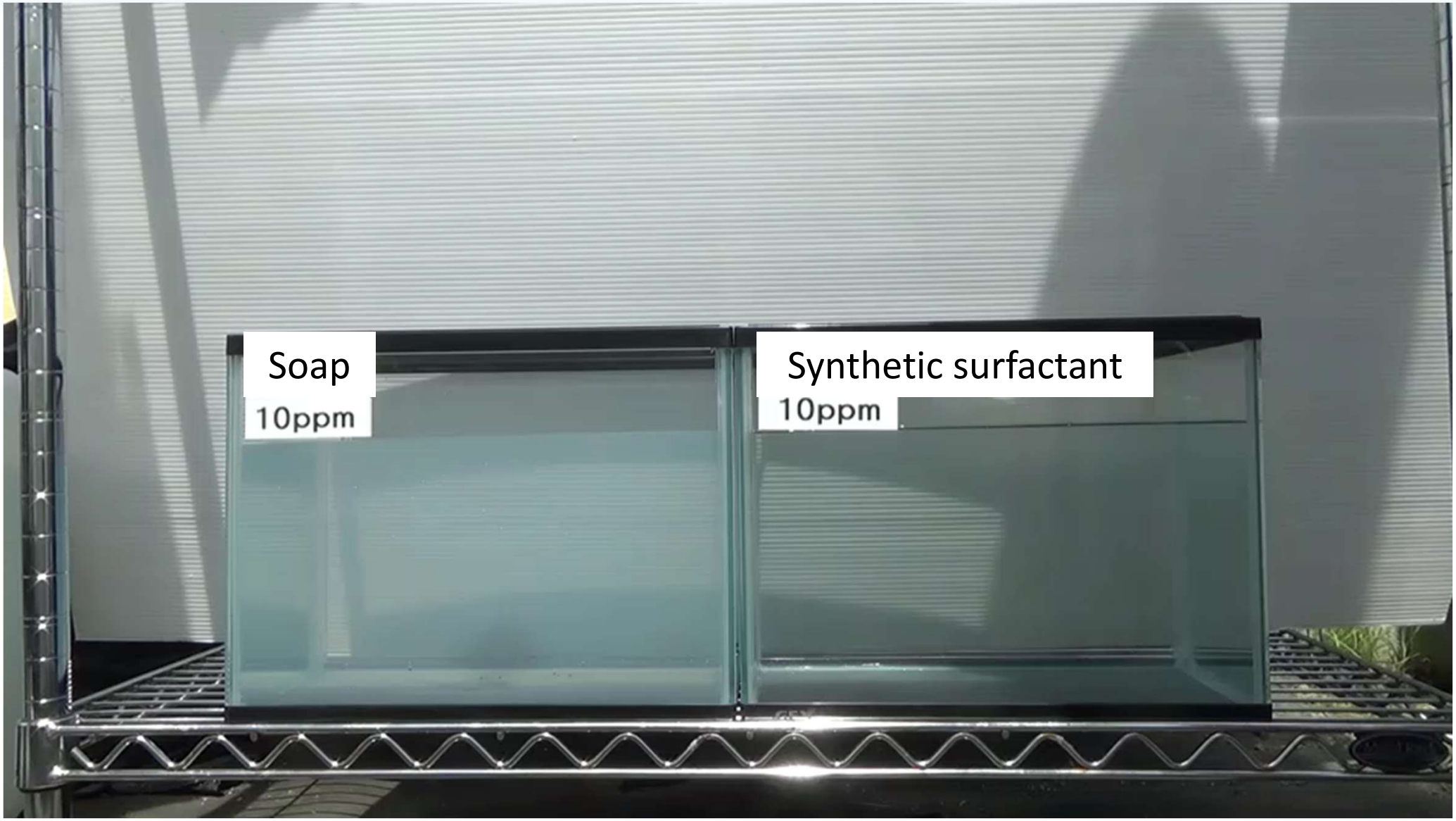


International Wound Journal, Volume: 18, Issue: 4, Pages: 467-477, First published: 12 January 2021, DOI: (10.1111/iwj.13547)

Recommended by Japan Atopic Dermatitis Patients Association

Products based on the vision "Protect healthy body and clean water" contributes to the goal 3 (Health), 14 (Ocean), 15 (Land)

Low toxicity to life in water



Kawano lab, The university of Kitakyushu

Soap-based firefighting Foam

Retardnat effect

High firefighting effect

Wettability, Penetrability

Fast defoaming

Bubbles disappear immediately

Eco-friendly

Low toxicity, 100% Biodegradation

- ✓ Soap-based firefighting Foam is specifically for fresh water and the concentration for use is 1%
- ✓ Soap-based firefighting foam can be used in building fires and wildfire
- ✓ Certified by Japan Fire Equipment Inspection Institute

Specification of Soap-based firefighting foam

Certification number (in Japan)			Class A firefighting foam 1% (Foam No. 19 ～23)
Capacity			20 L
Operating Temperature Range [℃]			-10 ~ +30
Concentration used			1.0%
Physical properties	Kinematic viscosity at 20℃ [cSt]		49
	Pour point [℃]		-32.5
	pH		10.13
	Mass loss to corrosion [mg/20cm^2/day]	Steel	0.008
		Brass	0.078
		Aluminum	2.325

Firefighting performance

Study of Prof. Uezu of The university of Kitakyushu

H. Mizuki et al., (2007). Novel environmental friendly soap-based fire-fighting agent. *J. Environ. Eng. Manage.*, 17(6), 403-408.
https://www.researchgate.net/publication/225088889_Novel_environmental_friendly_soap-based_fire-fighting_agent

Soap-based firefighting foam and synthetic firefighting foam were able to extinguish after the third spraying.
Soap-based firefighting foam have the same fire-extinguishing performance as synthetic firefighting foam.

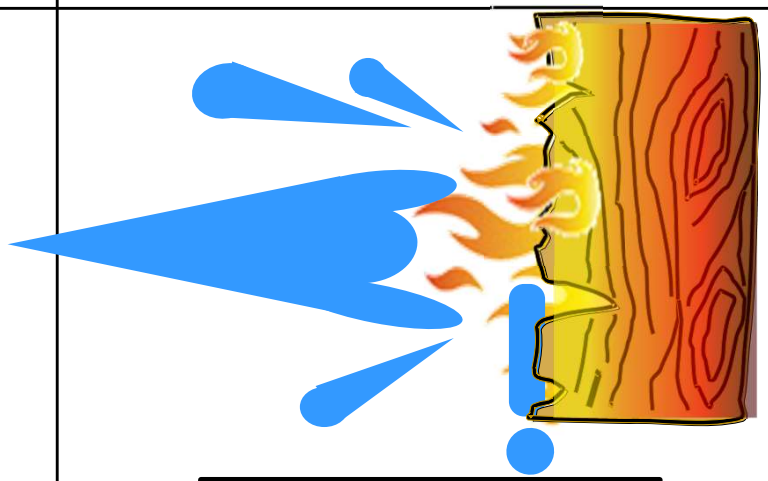
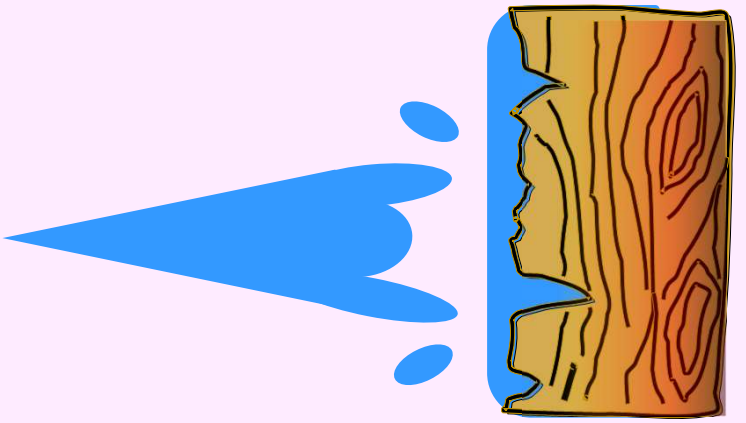
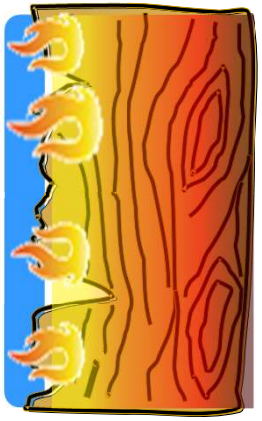
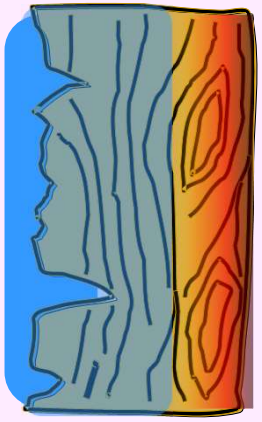
Water cannot be extinguished many times spraying.

Number of water discharges

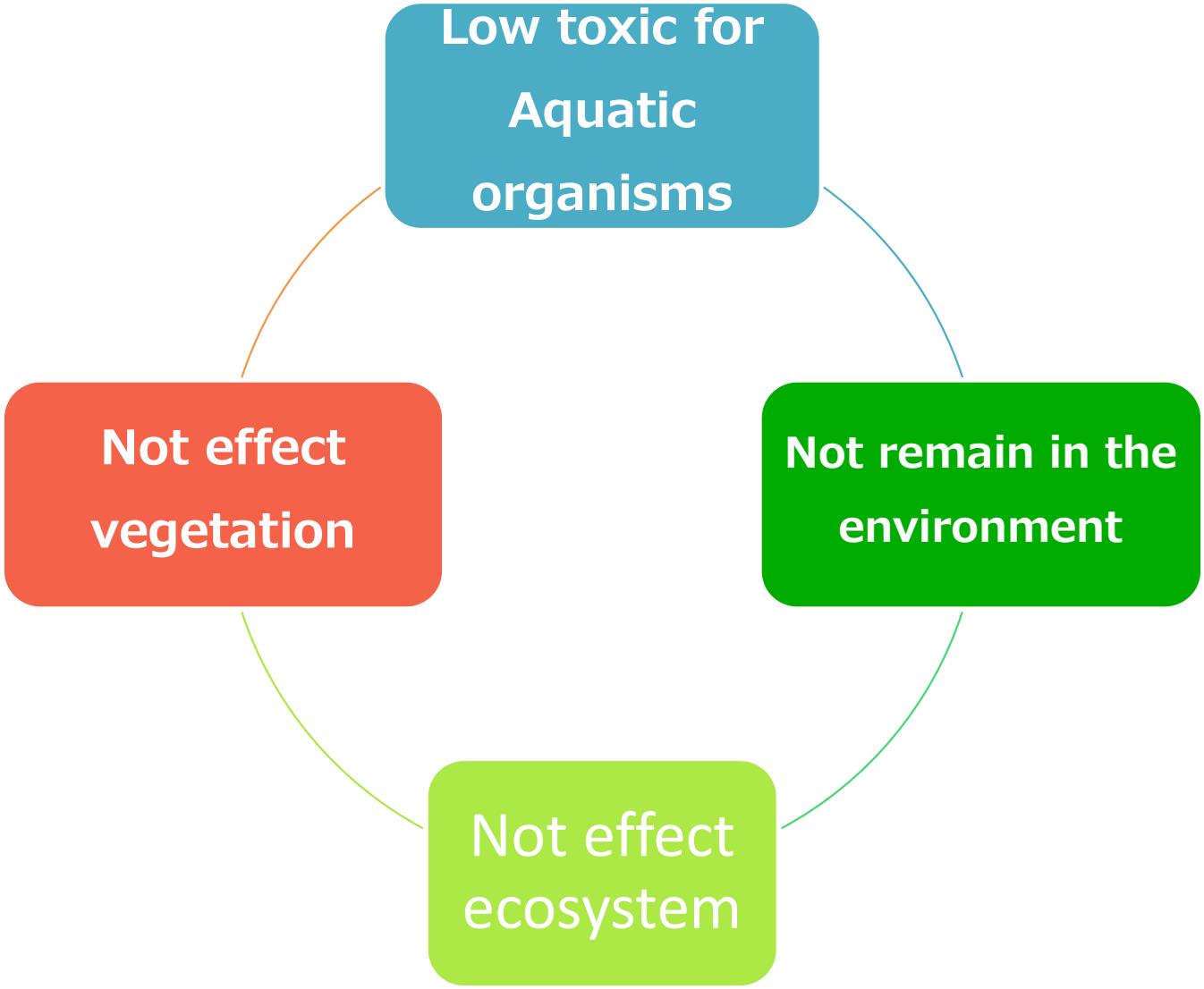
	1	2	3	4
water				
Synthetic -based				
Soap -based				

Mechanisms

The firefighting foam including surfactant has excellent wettability and permeability.

	water	Firefighting foam
Wettability	 hard to get wet	 Easy to get wet
Permeability	 Hard to get penetrate	 Easy to penetrate

Eco-friendly



Low toxic for Aquatic organisms

Study of Prof. Kawano of The university of Kitakyushu

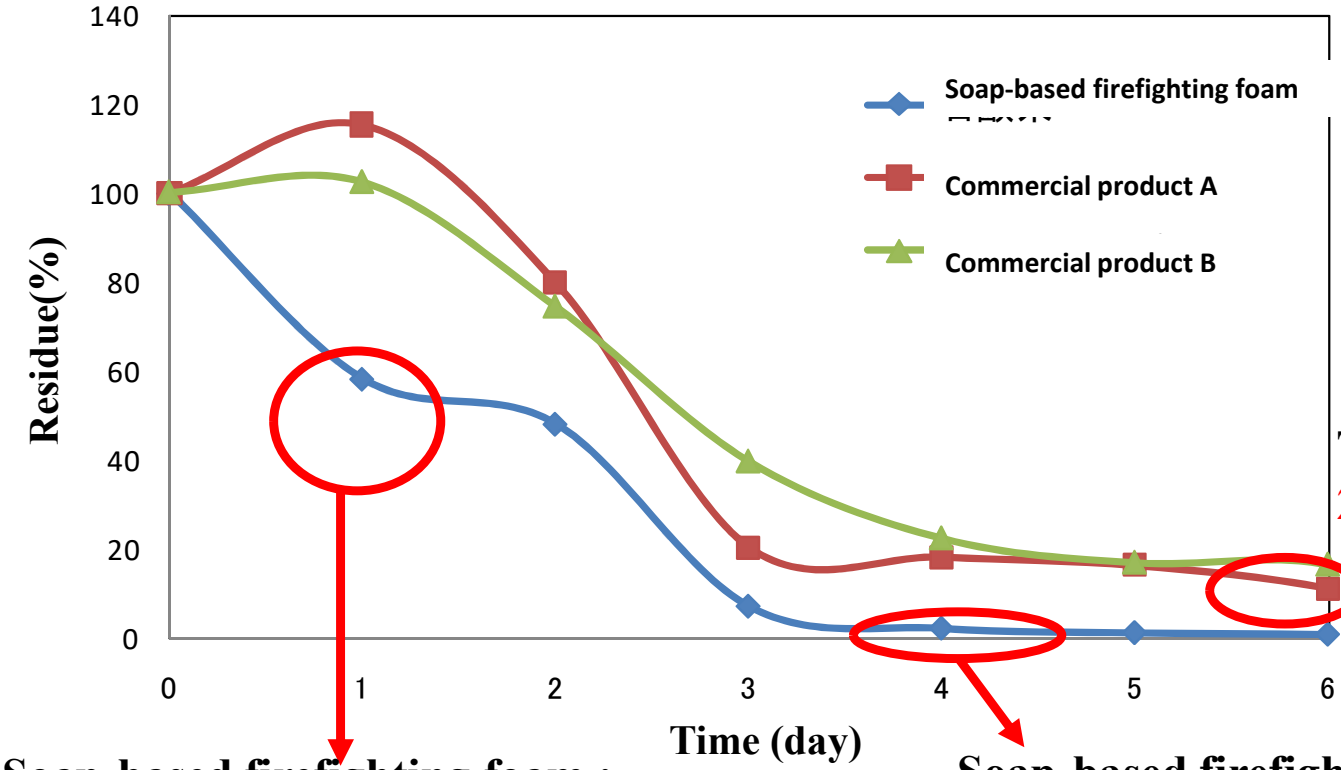
H. Mizuki et al., (2007). Novel environmental friendly soap-based fire-fighting agent. *J. Environ. Eng. Manage.*, 17(6), 403-408.
https://www.researchgate.net/publication/225088889_Novel_environmental_friendly_soap-based_fire-fighting_agent

Toxicities(LC_{50}) of Firefighting Foams in Oryzias latipes

Brackish water	at 12 hours (ppm)	at 24 hours (ppm)	at 48 hours (ppm)
Soap based firefighting foam	4000	1330	650
Commercial product A	15	7.5	7.5
Commercial product B	65	55	20
Commercial product C	65	20	20
Commercial product D	185	133	73

Not remain in the environment

Study of Prof. Yasui of The university of Kitakyushu



Concentration：1000［mgCOD/L］
Temperature：25℃
Phosphate buffer (pH=7.2) 500ppm

The commercial products:
20% of organic carbon still remained

Soap-based firefighting foam :
40% of organic carbon disappeared in 1 day

Soap-based firefighting foam:
100% of organic carbon was disappeared

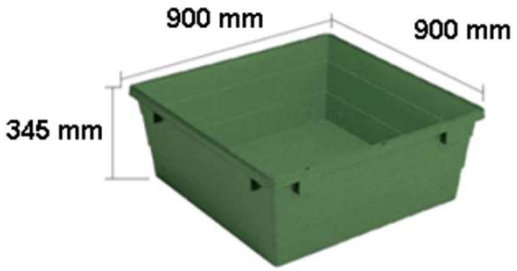
- Soap-based firefighting foam is 100% biodegradable and do not remain in the environment.
- Soap-based firefighting foam have little effect on microorganisms in soil

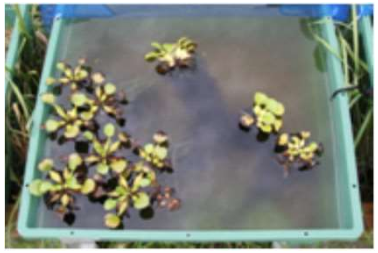
Test Laboratory:Research and Development Center of Fire and Environmental Safety, The University of Kitakyusyu

No effect for ecosystem

Study of Prof. Kawano of The university of Kitakyushu

T. Kawano et al., (2014). Eco-Toxicological Evaluation of Fire-fighting Foams in Smaal-Sized Aquatic and Semi-aquatic Biotopes. Advanced Materials Research,875-877, 699-707. https://www.researchgate.net/publication/272071490_Eco-Toxicological_Evaluation_of_Fire-Fighting_Foams_in_Small-Sized_Aquatic_and_Semi-Aquatic_Biotopes





Before

1% firefighting foam Spraying

7 months later

The same number of organisms as water grows. After spraying the soap-based firefighting foam, the impact on the ecosystem was low, such as dragonflies laying eggs and larvae growing.

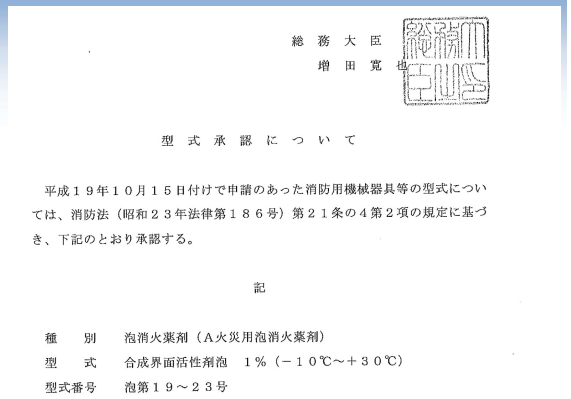
Synthetic fire fighting foam kill organisms.

Not affect vegetation

	Soap-based	Water
Before		
After		
10 months later		

Even after spraying soap-based firefighting foam, the plant recovered to the same or better than when spraying with water.

Safety for human



総 務 大 臣
増 田 寛 也

型 式 承 認 に つ い て

平成１９年１０月１５日付けで申請のあった消防用機械器具等の型式については、消防法（昭和２３年法律第１８６号）第２１条の４第２項の規定に基づき、下記のとおり承認する。

記

種　　別　　泡消火薬剤（Ａ火災用泡消火薬剤）
型　　式　　合成界面活性剤泡　１％（－１０℃～＋３０℃）
型式番号　　泡第１９～２３号

Certified by Japan Fire Equipment Inspection Institute

Adopted by firefighting headquarters in all prefectures in Japan

No safety issues after 15 years of use in Japan

Why is it safe?

SOAP + Ca^{2+} → soap scum (metallic soap)

Soap-based firefighting foam have quickly defoaming.

5. Actual use of soap-based firefighting foam

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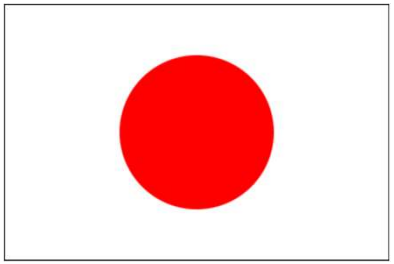
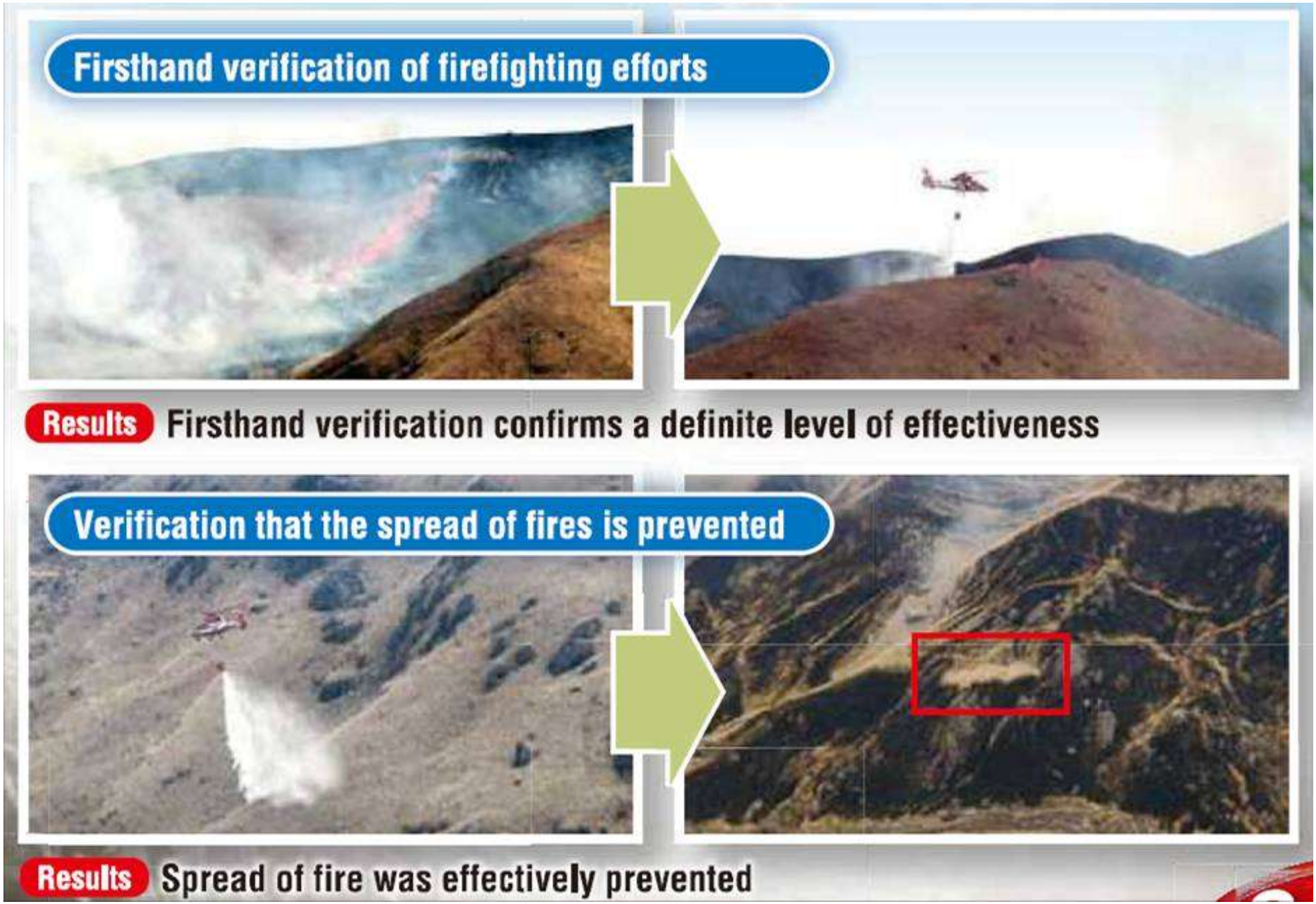


For forest fires



For forest fires

About wildfire and firefighting activity

- ✓Aerial firefighting with a helicopter using soap-based Class A foam
- ✓Aerial firefighting times: 18 times
- ✓Amount of water: 9,000 L
- ✓Fire extinguished: about 2 hours
- ✓Burnt area: about 106 rai

Other case
- ✓Aerial firefighting with a helicopter using Water
- ✓Aerial firefighting times: 31 times
- ✓Amount of water: 15,500 L
- ✓Burnt area: about 206 rai

【Effects of Soap-based Class A foam】

- ✓ **The fire could be extinguished with a one-time spray of water.**
- ✓ **Reignition did not occur after spraying.**
- ✓ **For the pilot, “After spraying, we could visually confirm that the fire had been successfully extinguished because the foam remained.“**

For management of burning field

How to use firefighting foam

Fire engine

Water tank

1 : 100

Backpack-type fire extinguishing equipment

Automatic chemical mixing system (Line proportioner, etc.)

Aerial firefighting (Helicopter, etc.)

Thank you for your attention.