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SARAYA

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Gladiolus

The yellow gladiolus is an ornamental flowering plant in the genus Gladiolus (family Iridaceae), valued for its tall, upright spikes and large, ruffled blossoms that open sequentially along the stem. Native primarily to southern Africa, it grows from underground corms and thrives in full sun and well-drained soil. The yellow variety is especially appreciated for its vibrant color and is commonly used in gardens and floral arrangements, where it symbolizes joy, vitality, and strength of character

World Information

Challenges and Pitfalls in Hand Hygiene Culture

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The Landscape of Healthcare-Associated Infections (HAIs)

Hand hygiene is one of the key practices to prevent healthcare-associated infections (HAI) and interrupt the transmission of pathogens that are transmitted by contact, particularly multidrug-resistant organisms (MDRO), which can cause high mortality. Since its first intervention by Dr. Ignaz Philipp Semmelweis, the science and practice of hand hygiene have progressed, but gradually. It was not until the late 1990s when Professor Didier Pittet demonstrated an inverse correlation between methicillin-resistant *Staphylococcus aureus* infection rates and hand hygiene compliance (1). Furthermore, he found that alcohol based hand rub solutions cannot only significantly decrease the amount of time healthcare workers (HCWs) spend on hand hygiene but also have better efficacy than soap and water. Subsequently, the World Health Organization (WHO) introduced the campaign 'SAVE LIVES: Clean Your Hands' worldwide, which included the 5-strategy approach and 5-moment framework for hand hygiene. Later studies suggested that adding three more strategies—namely, goal setting, incentive and accountability—to the existing ones could further increase hand hygiene compliance (2).

However, it is still very difficult to achieve and maintaining high hand hygiene compliance in healthcare facilities worldwide. The average hand hygiene compliance rate ranges between 20% in low-income and 40% in high-income countries (3,4). Some of the barriers to hand hygiene include suboptimal infrastructure, such as lack of adequate hand washing sinks and good quality alcohol-based hand rub solutions, high workload, understaffing, and inappropriate behaviour norms, patterns and role modelling (5). Time constraint has been a major barrier to hand hygiene, but it was resolved after shifting toward using alcohol-based hand rub solution instead of soap and water. Using alcohol-based hand rub solutions also partially downgrades the magnitude of tension created by understaffing and high workload.

Wearing gloves is increasingly recognised as a predictor of non-compliance with hand hygiene. This is because many HCWs perceive that gloves are absolute protection against hand contamination. Simultaneously, HCWs also tend to perceieve that hand hygiene interrupts the workflow. Consequently, they would incline to wear gloves for every patient care activity and omit hand hygiene. Therefore, the WHO promoted 'It might be gloves. It's always hand hygiene' as the main theme of 2025's World Hand Hygiene Day. Furthermore, countries with limited resources continue to use powdered gloves because they are widely available at lower cost. However, using powdered gloves makes hand hygiene with alcohol-based hand rub solutions difficult, because residual powder can aggregate on the hands, interfering with the antimicrobial properties of alcohol, and can also create uncomfortable feeling. In addition, powdered gloves are associated with latex allergy and may trigger asthmatic attacks among people with asthma. The healthcare system, therefore, should focus on using non-powdered gloves, and industries manufacturing them should prioritise making good-quality and cost-effective gloves.

Sustainable hand hygiene requires the implementation of the multifaceted approaches mentioned above, and leadership is a critical part of this process. It is important for hospital administrators to understand that investment in hand hygiene is cost-effective, not a financial burden. A recent study in Vietnam showed a 10% reduction HAI when hand hygiene compliance increased from 26% to 58%, saving $1,074 per HAI prevented, while the hand hygiene program costed only $6.5 per patient (6). Hospital administrators can support hand hygiene programs by providing adequate resources to establish an adequate handwash basins, continuous supply of alcohol-based hand rub solutions at the point of care and non-powdered gloves.

Being the role model of good hand hygiene practices by hospital leaders can significantly influence the norms of HCWs. Thus, in addition to managing the budget, leaders at all levels of the hospital units must consistently perform hand hygiene according to the 5-moment guidance and provide direct feedback to HCWs and the hand hygiene (HH) team. Monitoring and feedback both in terms of overall compliance within specific areas of the hospital or among HCWs (e.g., physicians, nurses and students) and direct feedback when non-compliance is detected may lead to change in behaviour of HCWs. Hand hygiene compliance rates should be reported to each sector of the hospital along with HAI rate and prevalence of MDRO so that all stakeholders can easily recognize the benefit of hand hygiene. On the other hand, hospitals should not set the goal to achieve 100% hand hygiene without emphasizing the ultimate outcomes—HAI and MDRO rates, because that will likely lead to falsely high rates of hand hygiene compliance.

Hand hygiene technique has been a topic of interest. Recent research indicated that a 3-step hand rub takes less time and may increase compliance while maintaining similar HAI and MDRO rates as compared to the traditional 6-step suggested by the WHO (7). The three steps include (1) rubbing all surfaces of the hands, particularly both palms, (2) rotationally rubbing the fingertips on the palm of the alternate hand and (3) rotationally rubbing both thumbs. The total HH median time for the 3-step process was half that of the 6-step process, and the observed hand hygiene compliance rates were 84.88% and 76.85%, respectively (7). While this is important in HCW training, in real-life practice, during hand

hygiene observation, the observers usually focus only on whether the hand hygiene is performed rather than how the HCW rubs his/her hands.

Finally, the hand hygiene campaign is an endless activity in healthcare system because hand hygiene is a learned behaviour that needs repetitive reminding. Therefore, having a permanent group of people working in this area as well as support from hospital administrators are vital for this sustainable hand hygiene program. Linking HAI and MDRO rates with hand hygiene compliance could eventually create a safety culture in the healthcare system, which is the ultimate goal of a hand hygiene campaign.

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日本語要約

手指衛生文化の課題と落とし穴

手指衛生は医療関連感染（HAI）を防ぎ、多剤耐性菌（MDRO）などによる感染拡大を防止する対策の1つです。しかし、手指衛生遵守率の平均は、低所得国で20%、高所得国で40%に留まっています。手袋着用が感染予防における完全な手段であると考える医療従事者も多く、遵守率が低い一因となっています。持続可能な手指衛生には多角的アプローチが必要ですが、中でもリーダーシップは重要です。管理者は模範的行動を示し、手指衛生が費用対効果の高いものであると理解すべきです。ベトナムで行われた調査では、手指衛生の遵守率が26%から58%に向上したことで、HAIが10%減少し、予防されたHAI1件あたり1,074ドルの節約となった一方、手指衛生に係る費用は患者1人あたりわずか6.5ドルでした。手指衛生は繰り返し注意喚起する必要があり、終わりのない活動です。その為、スタッフや管理者の支援が不可欠です。HAIやMDROの発生率と手指衛生遵守率を関連付けることで、最終的には医療システムにおける安全文化の醸成につながり、それが手指衛生キャンペーンの最大の目標となります。

Jigger Infestation in Kenya and Treatment Innovation

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Abstract

Jigger infestation, medically referred to as tungiasis and caused by the sand flea *Tunga penetrans*, is a neglected parasitic disease affecting vulnerable populations in Kenya and other parts of sub-Saharan Africa. The condition is characterised by the penetration of gravid female fleas into the skin, most commonly affecting the feet. The associated morbidity includes pain, inflammation and secondary bacterial infections, as well as social consequences, such as stigma, school absenteeism and reduced economic productivity. Government and civil society estimates that a substantial number of Kenyans are affected, with children, older persons and individuals living in poverty bearing a disproportionate burden.

In response to this public health challenge, the Government of Kenya developed the National Policy Guidelines on the Prevention and Control of Jigger Infestations to provide a coordinated, multi-sectoral framework for prevention and management. This article reviews the epidemiology and public health importance of tungiasis in Kenya and outlines the national policy framework and key implementation strategies. It also discusses emerging programmatic treatment innovations that aim to strengthen safe community-level management in alignment with Sustainable Development Goal 3.3 on neglected tropical diseases.

Introduction

Tungiasis is a parasitic skin disease caused by the sand flea *Tunga penetrans*. The disease predominantly affects populations living in resource-limited environments in which housing conditions, environmental hygiene and access to preventive measures are inadequate. In endemic areas, transmission is strongly associated with poverty, earthen floors, dusty surroundings and limited use of protective footwear.

Although tungiasis rarely causes life-threatening complications, the disease causes substantial suffering due to persistent pain, inflammation, itching and difficulty walking. In chronic or untreated cases, secondary bacterial infections, nail deformation, ulceration and tetanus may occur. Beyond physical morbidity, affected individuals often experience social stigma, exclusion and psychological distress, particularly among school-aged children.

Despite its prevalence in many African settings, tungiasis has historically received limited attention within national health planning and global neglected tropical disease (NTD) frameworks.

Life Cycle and Transmission Dynamics

The life cycle of *Tunga penetrans* includes both parasitic and off-host developmental stages. Once the gravid female flea has penetrated the epidermis of the human host, it enlarges and releases eggs over several days. These eggs fall into dry soil, where larvae and pupae develop under warm environmental conditions.

Human infection occurs primarily through direct contact with contaminated soil, especially when individuals walk barefoot. Transmission is therefore closely linked to environmental exposure, housing quality and socio-economic vulnerability. Domestic animals, such as dogs, cats, pigs and goats, may serve as reservoir hosts, contributing to persistent household transmission in endemic settings.

These characteristics highlight that tungiasis is shaped largely by environmental and social determinants rather than biological susceptibility.

Burden and Public Health Importance

Tungiasis remains widely prevalent in many parts of Kenya, particularly in rural and marginalised communities. Although comprehensive national prevalence surveys are limited, reports from government agencies, academic studies, and civil society organisations consistently identify the disease as a significant public health concern.

Children are disproportionately affected due to frequent barefoot exposure and prolonged contact with contaminated soil. Recurrent infestation may impair mobility and contribute to school absenteeism and reduced participation in learning activities. In adults, tungiasis can limit physical productivity and contribute to household economic strain.

The disease also increases vulnerability to secondary infections in communities where access to health services is limited. Despite these impacts, tungiasis is underreported in routine health information systems, complicating accurate disease mapping and resource allocation.

National Policy Guidelines on the Prevention and Control of Jigger Infestations

In recognition of the public health burden of tungiasis, the Government of Kenya developed the National Policy Guidelines on the Prevention and Control of Jigger Infestations in 2014 through the Ministry of Health's Division of Environmental Health. The guidelines were developed through consultation with county governments, researchers and civil society partners.

The policy provides a framework for coordinated prevention and control efforts at the national and county levels. It promotes the integration of tungiasis interventions into existing community health strategies, school health programmes, environmental sanitation initiatives and broader NTD control efforts.

Importantly, the policy recognises tungiasis as a disease

influenced by social, environmental and economic determinants, necessitating multi-sectoral collaboration beyond the health sector alone.

Policy Objectives

The guidelines aim to achieve the following:

- Reduce the occurrence of jigger infestation
- Promote safe and appropriate prevention and management practices
- Strengthen community awareness and participation
- Improve surveillance and reporting mechanisms
- Enhance collaboration across the health, education, water, sanitation, housing and community development sectors

These objectives situate tungiasis within both public health and development agendas.

Strategic Interventions for Prevention and Control

Environmental Hygiene and Housing Improvement

Environmental management remains a cornerstone of prevention. Regular cleaning of living spaces, proper waste disposal and improvement of housing conditions reduce flea breeding sites. Replacement of earthen floors with finished surfaces has been associated with a lower infestation risk in endemic areas. The separation of animal shelters from human dwellings is also recommended.

Personal Protective Practices

The consistent use of footwear, routine bathing and regular inspection of feet are promoted as key preventive behaviours, particularly among children.

Health Education and Behaviour Change Communication

Community education initiatives address misconceptions associating jigger infestation with superstition or moral judgment. Behaviour change communication promotes an accurate understanding of transmission, prevention and safe treatment options, supporting early care-seeking and stigma reduction.

Clinical Management and Safe Treatment

The national guidelines discourage the mechanical extraction of jiggers using unsterilised instruments due to the increased risk of infection and tetanus. Instead, the guidelines emphasise safe wound care, topical antiseptic use and management under the guidance of trained health workers where possible.

Surveillance and Health Information Systems

The policy recommends the incorporation of tungiasis reporting into routine health information systems. However, implementation remains inconsistent, highlighting the need for strengthened surveillance and monitoring mechanisms.

Multi-sectoral Coordination

Effective control requires collaboration among the health, education, water and sanitation, housing and community development sectors. School-based screening and community mobilisation remain important components of integrated prevention strategies.

Community Engagement and Programmatic Treatment Innovation

Community-based interventions play a central role in tungiasis management in Kenya. Civil society organisations, county governments and community health volunteers have implemented prevention and treatment campaigns that emphasise hygiene, education and safe care practices.

Within this context, programmatic treatment innovations have emerged to support safer community-level management. Partnerships between private sector actors and civil society organisations, such as the collaboration between Saraya and Ahadi Kenya Trust, have focused on developing standardised topical formulations intended to simplify application and reduce reliance on unsafe extraction methods.

While large-scale clinical trials remain limited, such innovations strengthen the operational components of Kenya's national policy framework by promoting safer, more practical approaches in community settings.

These efforts align with Sustainable Development Goal 3.3, which calls for strengthened responses to NTDs through improved access to prevention and care.

Challenges and Remaining Gaps

Despite policy and programmatic progress, several challenges persist. These include limited routine surveillance data, ongoing stigma, variable county-level resource allocation and incomplete integration of tungiasis into primary healthcare and NTD programmes. Addressing these gaps requires sustained investment, improved monitoring systems and long-term community engagement.

Conclusion

Tungiasis remains a significant yet preventable public health challenge in Kenya. The disease is closely linked to poverty, environmental exposure and limited access to basic services. Kenya's National Policy Guidelines on the Prevention and Control of Jigger Infestations provide a strong foundation for coordinated action. With community engagement, improved surveillance and safe programmatic innovations, progress towards disease reduction and improved quality of life for affected populations is achievable. Strengthening implementation will contribute to health equity, social dignity and broader sustainable development outcomes.

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New Material Sophorolipid (SOFORO) and Its Applications in Healthcare Settings

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Introduction

In medical settings and nursing homes, hand hygiene and the proper reprocessing of medical instruments are crucial for ensuring the safety of patients and healthcare workers. As medical technology, including regenerative medicine, becomes more advanced, society is requiring that medical materials be selected based on multiple criteria, including efficacy, environmental compatibility, and biocompatibility.

In recent years, biosurfactants, namely, new materials that can be mass-produced by microorganisms using fermentation technology, have been drawing attention as next-generation surfactants to replace traditional petroleum-based synthetic surfactants. As fermentation products, biosurfactants are highly biodegradable. They also have low toxicity, a low environmental impact, and low flammability. None of these properties are found in traditional petroleum-based synthetic surfactants[1].

In this article, the new sophorolipid (SOFORO), which is produced by fermentation using the yeast *Starmerella bombicola*, is introduced, with a focus on its use in healthcare settings.

New Material SOFORO

SOFORO is a glycolipid-type biosurfactant produced by the yeast *Starmerella bombicola* through the fermentation of sugar and vegetable oil (Figure 1). Similar to bioplastics and the like, SOFORO is positioned as a representative material that can replace petroleum-derived chemicals with bio-derived alternatives. This is in line with the Japanese government's push for decarbonisation by transitioning away from fossil fuel dependence and industrial structure transformation centred on fermentation technology (Figure 2). Following the discovery of SOFORO in 1969, many researchers tried to find practical applications for this biosurfactant; however, none of these attempts were economically viable. A turning point came in 2001, when SOFORO was first commercialised as a detergent for household dishwashers. Its high cleaning performance and environmental compatibility were recognised, which led to its widespread adoption as a recommended product by major home appliance manufacturers[2].

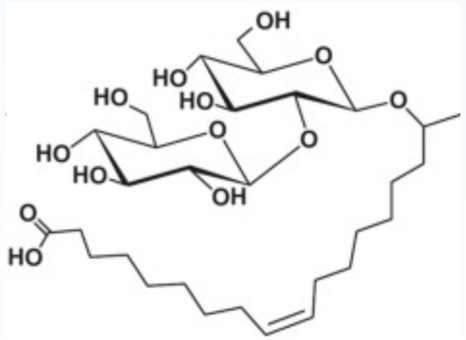

Figure 1. SOFORO chemical structure

SOFORO boasts cleaning and emulsifying properties comparable to those of conventional petroleum-based surfactants while also being biodegradable and having low irritating effects. This new material thus enables the development of products where both people and the environment are taken into consideration (Figure 2). Its applications are now expanding beyond detergents to include cosmetics and food. SOFORO has numerous applications in the healthcare settings.

Figure 2. Basic characteristics of SOFORO

Reprocessing of Medical Devices

The quality of cleaning, disinfection, and sterilisation of medical devices in the central sterile supply departments of hospitals is extremely important in preventing hospital-acquired infections. When cleaning using a washer disinfector, the excessive foaming of conventional surfactants can hinder the physical cleaning process, which increases the risk of contaminant reattachment (recontamination).

SOFORO is used in medical device detergents, such as the Power Quick series, because of its extremely rare low-foaming property. The foam formed by SOFORO-formulated detergents during the cleaning process is unstable and collapses immediately, thus fully utilising the physical cleaning power of the jet stream of the washer disinfector and promoting and accelerating contaminant removal. SOFORO-formulated detergents offer superior cleaning power and rinsability, making them effective for cleaning medical devices with complex structures.

Low-foaming enzyme-based immersion detergents that incorporate SOFORO and are used in the pre-cleaning step prior to washer disinfector cleaning have been put to practical use. SOFORO's high efficiency and excellent material compatibility with medical devices have led to its widespread use in medical device reprocessing in recent years.

Power Quick Enzyme Cleaner for Manual Soaking Neutral, Low Foaming

Power Quick Multitype Enzyme Cleaner for Manual Soaking Weak Alkaline, Low Foaming

Power Quick Cleaner for Automated Washers Neutral, Low Foaming

Hand Care (Hand Soap)

Establishing handwashing as a fundamental infection prevention habit requires products to have cleansing properties while being comfortable to use. Including SOFORO in the formulation improves the low-temperature stability and foaming ability of soap under hard water conditions. However, its low foaming property means it may compromise the foamability and creaminess of formulations like body washes. This issue was resolved by combining soap (fatty acid salt) with SOFORO in a specific ratio to achieve a fine, elastic, and soft foam that is gentle and pleasant on the hands. Furthermore, the addition of essential oils and other aromatic ingredients has been shown to significantly reduce multiple negative moods, including anger, hostility, tension, and anxiety. Incorporating SOFORO into hand soaps has been shown to enhance handwashing by not only controlling infection but also providing a relaxing effect for the mind and body.

Wash Bon Prime Foam Hand Soap Sweet Floral / Fresh Citrus

Foot Care (Foot Care Sheet) and Skin Care

Our feet are the foundation of our bodies and support all our daily activities. They are prone to blood flow disorders and nerve damage, and even small wounds can lead to infection. Older adults, in particular, are at a high risk of experiencing skin problems, so it is important to monitor their foot health through daily foot care. Skinaru Foot Wipes, cleansing sheets formulated with SOFORO and the cationic antibacterial agent polyaminopropyl biguanide (PHMB), are mildly acidic and hypoallergenic and have been shown to have low cytotoxicity, which makes them safe for use even by older adults and people with diabetes who have fragile skin.

In a cleansing test using model sebum stains, Skinaru Foot Wipes demonstrated significantly higher cleansing efficiency rates than conventional products. Furthermore, the cleansing efficacy was significantly lower without SOFORO (Figure 3).

Aside from their high cleansing efficacy, cytotoxicity tests confirmed the low toxicity of the wipes with SOFORO, thus demonstrating their excellent safety. In a test using tinea fungus (*Trichophyton mentagrophytes*), SOFORO functioned as a carrier to promote PHMB penetration into the stratum corneum, leading to an enhanced antifungal effect. Wipe-off disinfection tests for tinea fungus showed that fewer bacteria remained compared to when our conventional product was used, thus demonstrating the high disinfecting performance of the wipes[3]. Because wipes with SOFORO can be used without water, it is suitable for situations where bathing is difficult, for home medical care and nursing, and as a disaster preparedness item. They can also be conveniently heated in a microwave or towel warmer before use. SOFORO is compatible with most wipe materials and has shown promising applications for delicate intimate zones, such as the perineal area, which have fragile skin structures.

Skinaru Foot Wipes

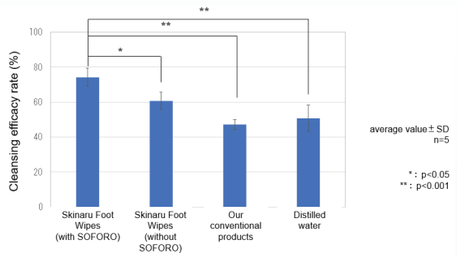

Figure 3. Cleansing efficacy of Skinaru Foot Wipes
The cleansing efficacy was evaluated using model sebum stains, in accordance with JIS S 3303 Test Method for Disinfection Performance of Wet Wipes and Disinfection Effect.

The perineal area, with its thin and easily macerated stratum corneum, is a vulnerable area of skin, which is susceptible to friction and other irritants. It is thus at risk of skin problems such as candidiasis, so it is important to maintain a clean environment. While liquid or foam-type cleansers are commonly used for perineal cleansing, the procedures associated with these cleansers are tedious and prone to inconsistencies. Furthermore, given the recent labour shortage, demand for wipes has increased. SOFORO has demonstrated high compatibility with wipe materials, which makes it suitable for use in perineal cleansing wipes used to clean the fragile skin of the perineal area.

Skinaru Perineal Cleaning Wipes (Refreshing)

The results of a cytotoxicity test on the safety of SOFORO are shown in Table 1[4]. SOFORO was confirmed to be more than 100 times less toxic than the commonly used surfactants polyoxyethylene alkyl ether and sodium polyoxyethylene alkyl ether sulphate and more than 50 times less toxic than polysorbate 80, which is also used in the formulations of injectables and the food additives sucrose fatty acid esters and glycerine fatty acid esters. Additionally, SOFORO is suitable for caring for fragile areas with a weakened skin barrier.

Table 1. Low cytotoxicity of SOFORO

Surfactant	Half-maximal inhibitory concentration (IC_{50}) mg/L
SOFORO	57,000
Polysorbate 80	1,000
Sucrose fatty acid esters	700
Glycerine fatty acid ester	400
Polyoxyethylene alkyl ether	<10
Sodium polyoxyethylene alkyl ether sulphate	150

※ **Test cells**: HeLa cells; **Method:** MTT assay after 48 hours of exposure

Wound Care

Nanobubbles are nano-sized bubbles less than 1 μm in size. Their microstructure allows them to remain stable in water without floating or bursting. They are highly functional, with excellent cleansing, penetration, and diffusion properties, which makes them suitable for a variety of applications. Previously, they were produced using high-speed vortex flow or pressurised dissolution methods, which required specialised equipment. However, a powder mixed with SOFORO and carbonates alone has been found to produce high-quality nanobubbles (SOFORO fine bubbles; 300 nm or less and a density of 1 billion bubbles/mL) simply by dissolving it in water. SOFORO fine bubbles have been shown to be effective in removing biofilms from wounds (Table 2). When their ability to remove simulated biofilms was examined, only the SOFORO fine bubble system consisting of SOFORO and carbonates demonstrated significant biofilm removal (Table 2).

Animal experiments demonstrated that SOFORO fine bubble cleansing can be used without adversely affecting wound healing and is effective in promoting the healing of critical colonisation wounds, a condition primarily caused by biofilms. It has been suggested that this promotion of healing may be achieved by SOFORO fine bubble cleansing through its inhibition of the deep infiltration of bacteria into wound tissue.

Table 2. Biofilm decontaminating effect of SOFORO fine bubble system

Evaluated sample	Evaluation results	Judgment criteria
SOFORO fine bubble system	Excellent	
Carbonate salt only	Poor	
SOFORO only	Fair	

Regenerative Medicine

Regenerative medicine holds great promise as a life-saving technology to help overcome previously incurable diseases. To make regenerative medicine a reality, innovations in the peripheral technologies that support regenerative medicine are necessary. These include scaffolding materials for the proliferation of iPS cells and cryopreservation techniques that do not damage the proliferated cells. It has been discovered that SOFORO can cryopreserve cells in a high-quality state by altering the properties of water.

Dimethyl sulfoxide (DMSO) is a cryoprotectant used for cell cryopreservation. While highly effective, individual cells have unique characteristics, so DMSO-free cryopreservation solutions are also needed. SOFORO has been reported to suppress the formation of ice crystals during freezing with significantly smaller ice crystal sizes than those of DMSO[5]. Utilising this property, a DMSO-free cryopreservation solution (SOFORO Cryo) is commercially available as a research reagent Research and development are underway to enable clinical applications in the near future.

SOFORO Cryo

Conclusion

SOFORO is a highly safe glycolipid produced through fermentation technology. Its unique value extends beyond its role as a replacement for conventional petroleum-based surfactants, thus bringing unique value to the healthcare settings. Its range of applications, which continues to expand, currently includes low-foaming and high-cleaning performance in medical device reprocessing, low irritation and penetration enhancement in skin hygiene management, nanobubble technology in wound care, and DMSO-free cryopreservation in regenerative medicine. SOFORO plays an important role in Japan's bioeconomy strategy as a material that combines environmental impact reduction with high functionality. Further research and implementation using this material is expected to help solve issues in the healthcare settings and to realise a more sustainable and safe society.

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