DUAL-ANTIBAX (Organo-Metal-Clay) Antibacterial Cream

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ABSTRACT

The issue increases when germs or bacteria infiltrate the skin, resulting in an infected skin problem. The cost structure of treatment is similar to that of an iceberg, with material expenses accounting for 20% of the total and nursing and hospitalisation costs accounting for the remaining (bottom of the iceberg). As a result, it's vital to keep the skin problem from getting worse, particularly in Malaysia, where the tropical temperature favours bacterial growth. The most common treatment for skin disorders is antibiotic or hormone cream, which may be bought from clinics and pharmacies. Bacterial resistance, on the other hand, is caused by antibiotics. As a result, you can use the Dual-Antibax cream instead of these creams. There are two (dual) antibacterial agents in the Dual-Antibax cream: silver ions and a surfactant in a kaolinite carrier system. The kaolinite is employed as a carrier system for these two antibacterial agents, allowing them to be used in smaller doses while maintaining excellent efficacy. Dual-Antibax cream is a carrier system that comprises Dual-Antibax powder, which contains two antibacterial agents. The cream can be used to treat or prevent bacterial growth in certain skin disorders. Utility invention (UI2013700023) has been granted to the Dual-Antibax manufacturing process, which is now in the market-ready prototype stage. The claim in the intellectual property right (IPR) that there are two processes for Dual-Antibax manufacturing: (1) silver-kaolinite manufacture, and subsequently (2) surfactant attachment, establishes the uniqueness. The immediate effect for skin problem treatment with high efficacy and low cost, safe for humans, and based on a strong scientific approach is the product's value proposition. The cream's concept is akin to that of a cosmetic rather than a traditional therapeutic product in order to establish a bigger market size. The product will soon be available in a variety of market areas, including infant, health and beauty, and pet care goods.

Keywords: Antibacterial cream; kaolinite; silver; surfactant

INTRODUCTION

Once infected by bacteria, skin problems such as rashes, eczema, and others can become more severe and infectious. Because some pathogenic bacteria are resistant to antibiotics and antibacterial agents, treating infected skin is a serious concern in clinical practise today [1]. As a result, silver (Ag)-based products like silver nanoparticles and silver sulfadiazine could be

utilised to cure infection or prevent bacterial growth on the skin [2]. Overdosing on silver, on the other hand, can be hazardous to humans [3]. Silver nanoparticles, on the other hand, will cause mitochondrial collapse and DNA damage due to their smaller particle sizes and capacity to create reactive oxygen species (ROS) [4]. The essential aim of any antibacterial related material is the use of antimicrobial agents without compromising skin condition. As a result, it's critical to utilise an antibacterial agent that can prevent or destroy hazardous microbes while still being safe for human skin.

Silver, in the form of silver ions, has been shown to exhibit antibacterial properties, as well as favourable conductivity, stability, and activity, making it suitable for loading in a carrier system such as minerals clay kaolinite [5] or zeolite [6]. As a result, one of the alternative antibacterial agents is to use a silver-based solution, which has a broad-spectrum antibacterial action and the ability to kill bacteria on the skin. Various natural resources, such as herbs, honey, and, most crucially, clay, have been used to cure injuries or wounds since ancient times [7].

Due to its antibacterial activity against a broad spectrum of bacteria and synergistic impact with other chemicals [1, 8], silver-based products have become a very good antibacterial agent in recent decades. Silver has been shown to bind to the bacterial cell wall, cytoplasm, and inactive bacterial DNA, killing the bacterium as a result [9]. Clay's antibacterial activity could be improved by modifying it with silverIt can be protected from degradation and deliver a greater dosage at the site in a precise manner by immobilising on an appropriate carrier system. As a result, even if just a small amount of the antibacterial agent is used, its action is increased. The cationic surfactant quaternary ammonium compound is another antibacterial agent with antibacterial action (QAC). Hexadecyltrimethyl ammonium bromide (HDTMA), for example, has high affinity for electrolytes and can also limit bacterial biofilm formation and development [10].

As a result, this invention is concerned with the use of organo(HDTMA)-modified kaolinite (clay) as an antibacterial cream. The organo-silver-kaolinite, which is a modified kaolinite with two antibacterial agents, was made in a stepwise procedure: first, the silver-kaolinite was made by loading silver ions with half (50%) of the cation exchange capacity (CEC) of the kaolinite, and then the silver-kaolinite was attached with HDTMA at an initial concentration of 2.0 mM, which is slightly higher than its critical micelle concentration (CMC) value. The HDTMA molecules will attach to the silver-kaolinite surfaces, resulting in organic rich surfaces, which is why the modified clay is known as organo-metal-clay. The silver ions are situated inside the kaolinite [5] and then covered by HDTMA molecules at the exterior sites of the kaolinite surfaces [11], which makes this material unique. This could maximise the antibacterial potential of both antibacterial chemicals.

INNOVATION DEVELOPMENT

If we have a skin problem like rashes or eczema, we will visit a clinic or a pharmacy to obtain a pharmaceutical solution, and we expect rapid results. However, due of the problem of bacterial resistance to antibiotics, most of the products contain antibiotics, steroids, or hormones, which can either cure or worsen the condition. Aside from that, avoiding bacteria development on the skin is critical in preventing an infected skin disease from worsening. Furthermore, the true cost of treating infected skin problems is like an iceberg, with nursing and hospitalisation costs accounting for 90% of the total. As a result, Dual-Antibax cream, which contains two antibacterial agents in a carrier system, can prevent our skin from becoming infected or becoming more severe. Dual-Antibax cream is a topical cream that contains the

active component Dual-Antibax powder. The Dual-Antibax powder is a hybrid organic-inorganic substance that combines surfactant, an organic molecule, with silver ions, an inorganic ion, in a natural kaolinite carrier system. The Dual-Antibax cream contains potassium cornate, Melaleuca alternifolia (tea tree) leaf oil, Oryza sativa (Rice) bran oil, modified kaolin, salicylic acid, honey, and phenoxyethanol.

Figure 1: Picture of the Dual-Antibax cream.

The Dual-Antibax cream's uniqueness is based on the intellectual property given by the Malaysian Intellectual Property Corporation (MyIPO) under Utility Innovation [12]. The Dual-Antibax is made up of two important processes that make it a one-of-a-kind product:

Attaching to the clay by cation exchange a metal selected from silver, copper, zinc and their mixtures in an amount corresponding to 40-60 %, more preferably to less than 50 %, of the cation exchange capacity of the clay, thereby producing a metal-clay

Attaching to the metal-clay by cation exchange at least one quaternary ammonium compound by addition of excess amount of the quaternary ammonium compound, thereby producing an organo-metal-clay, which is the antibacterial agent.

Because there are two antibacterial agents in a carrier system in the Dual-Antibax as active ingredients, the degree of inventiveness is very high. The Dual-Antibax contains a small amount of silver ions, but it is quite effective at preventing bacteria development. This is because silver ions and surfactant, as an antibacterial agent, have synergistic effects. The use of two antibacterial agents which are silver ions and surfactant (HDTMA) are the antibacterial agents in a carrier system is the innovative concept.

The foundation of technological innovation is a solid fundamental principle. Dual-Antibax was discovered as a result of our study and experimentation at the Nanomaterials Laboratory, Department of Biosciences, Faculty of Science, UTM. To prepare this material, we must first determine the kaolinite's Cation Exchange Capacity (CEC), after which the silver ions are loaded to fill half of the place in the kaolinite. The surfactant molecules are then bonded to the silver-kaolinite surface. Based on this process, the amount of silver ions can be lowered by the attachment of the surfactant and nevertheless, it has excellent antibacterial activity.Figure 2 shows theoretical mechanism of formation of organo-metal-clay (Dual-Antibax) which is the attachment of surfactant on silver loaded kaolinite.

Two papers related to the invention development are listed here:

1) Muhammad Hariz Asraf, Atieya Abdul Hadi, Faisal Hussin, Nik Ahmad Nizam Nik Malek (2020). Antibacterial Metal-Loaded Kaolinites and Zeolites. In Nik Ahmad

Nizam Nik Malek (Ed) (2020). Antibacterial Agents (pp. 81-100). Johor Bahru: Penerbit UTM Press.

2) Muhammad Hariz Asraf and Nik Ahmad Nizam Nik Malek. Effect of Different HDTMA Loading on Silver Modified Kaolinite on its Antibacterial Activity. AIP Conference Proceedings 2231 (2020) 0420003

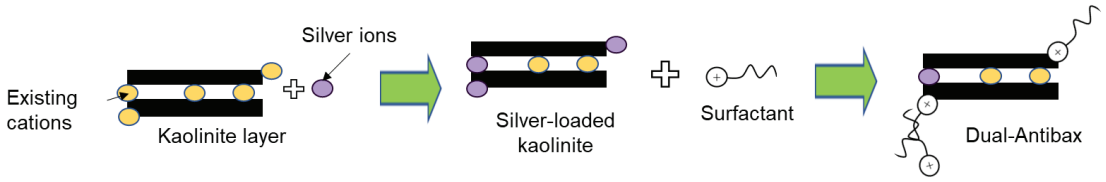

Figure 2: Theoretical mechanism of formation of organo-metal-clay

COMMERCIAL POTENTIAL

The use of Dual-Antibax cream on skin problems to prevent bacterial growth is highly relevant to Malaysia's geographical conditions. Malaysia is a tropical country with high humidity and temperatures, allowing microorganisms to thrive. Bad microbes can wreak havoc on our skin. As a result, by applying Dual-Antibax cream to the skin problem area, we can prevent our skin problem from worsening.

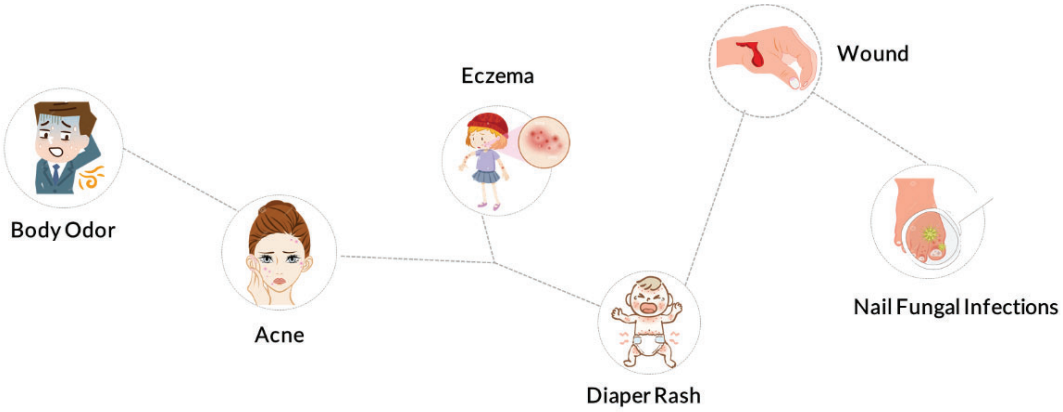

Figure 3: Technology application of the Dual-Antibax cream

Dual-Antibax cream is a biocompatible antibacterial agent that combines products for human skin's health and appearance. The skin care products market in Malaysia was valued $804.5 million in 2019 and is predicted to reach $1,288.7 million by 2027. (Allied Market Research). The market is growing in a healthy direction. From 2019 to 2024, the global market for antimicrobial compounds is expected to be worth $7 billion or more: Cosmetics and personal care items are increasingly containing antimicrobial agents (www.prnewswire.com). Everyone is looking for an effective antimicrobial agent because of COVID-19 and MCO, and the online marketplace is rapidly developing, allowing the Dual-Antibax cream to be offered on this platform. This product can be used by anyone with skin issues, including babies, toddlers, teenagers, and adults with skin issues and allergies, as well as diabetes patients and others.

When we compare Dual-Antibax cream to other antibacterial products on the market (Figure 4), we can see that the Dual-Antibax cream outperforms them. Most competitors in the

market utilise chemical antibiotics as active ingredients, while we use a low amount of surfactant and silver ions in a kaolinite substance in the Dual-Antibax cream. Antibiotics may cause bacterial resistance, rendering them ineffective and encouraging bacteria to become stronger.

Figure 4: Competition analysis

The Dual-Antibax product is simple to make, as it does not require high temperatures, energy, solvents, or sophisticated tools. Additionally, cosmetic-grade kaolinite is abundantly available in the area. In addition, the Dual-Antibax cream has a reduced production cost due to the lesser amount of silver and surfactant used. Due to synergistic effects, Dual-Antibax has been found to have strong antibacterial activity against a wide spectrum of bacteria (both Gram positive and Gram negative bacteria). It is simple to apply to the skin and has quick effects in terms of the customer. Dual-application Antibax's as a new antibacterial agent will help us learn more about hybrid organic-inorganic materials.

Dual-Antibax can save treatment expenses by inhibiting bacterial development and preventing skin diseases from worsening. The low-income group will benefit from this product because the cost of treating diseased skin diseases is a financial hardship for them. The Dual-Antibax cream can also be used in the event of a local crisis, such as a flood. Skin disorders caused by unhygienic circumstances and the environment can be prevented with the Dual-Antibax cream. Larger manufacturing locations and activity will be necessary due to the increasing demand for the Dual-Antibax product, creating job opportunities for our local talent. The usage of Dual-Antibax cream will open up a new market area for the treatment of skin issues using hybrid organic-inorganic components.

The development of Dual-Antibax cream has progressed to TRL6 since receiving prototype research fund from this project (Technology Readiness Level stage 6: Technology demonstrated in relevant environment). Before entering the commercialization stage, the Dual-Antibax cream must get multiple product certifications from relevant authorities (TRL7-TRL9). Furthermore, the production procedure for the active ingredient (Dual-Antibax powder) must

be perfected before it can be mass-marketed. ClayNiQ Enterprise will licensed the IPR and a joint venture (JV) will be formed to produce the Dual-Antibax powder. The product is scheduled to be sold this year, as it has already been approved by Malaysia's Ministry of Health (MoH). This product's commercialization approach is depicted in Figure 5. ClayNiQ Enterprise will enter into a licencing deal with UTM and manufacture Dual-Antibax powder. The cream will be produced and labelled by Biopro Consortium Sdn Bhd, an OEM business with a GMP (Good Manufacturing Practices) facility. Youbaby Millions Sdn Bhd and ClayRa Beauty and Health Enterprise would thereafter promote and distribute the cream. With this method, ClayNiQ Enterprise will have a better chance of finding other companies that are ideal for marketing and distribution for various market segments. Perhaps there will be products for pets such as cats and dogs in the future.

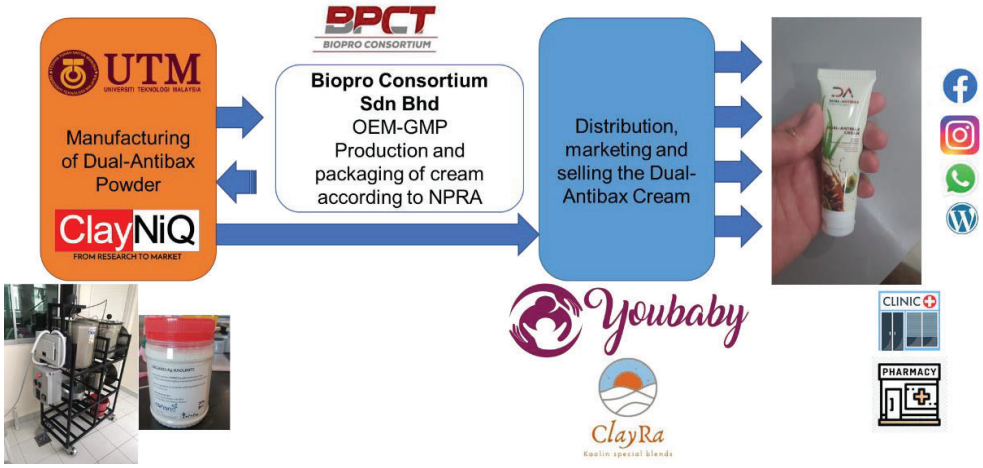

Figure 5: Commercialization strategy

CONCLUSION

Dual-Antibax cream is a novel antibacterial treatment for treating skin disorders. This product's innovation is based on Utility Innovation's claims, and it was produced using a rigorous scientific approach. The prototype development stage is complete, and the product is ready to be commercialised. Other novel items that can be developed from organo-metal-clay in the future include scrubs, facial masks, handwashes, shower creams, and other cosmetics.

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