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ANTIBACTERIAL ACTIVITY OF BARK CINNAMON CAUSING SKIN INFECTION

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Abstract: The antibacterial properties of cinnamon bark (Cinnamomum spp.) have long been recognized for their medicinal benefits. Two common types of bacteria were used in this experiment associated with skin diseases—Pseudomonas aeruginosa and Staphylococcus aureus—are tested for the antibacterial activity of cinnamon bark extract. The antibacterial activity of the extract was assessed using minimum inhibitory concentration (MIC) and agar well diffusion assays. The extract was prepared using ethanol and water-based solvents. The data showed strong antibacterial effect, particularly against the common skin infection-causing bacteria Staphylococcus aureus. These findings suggest that cinnamon bark extract could be a useful a substitute for traditional antibiotics in the management of skin infections, especially in view of the increasing incidence of antibiotic resistance. It is advised that more research be done to identify the active ingredients and assess the clinical safety and effectiveness of each.

Keywords: Topical therapy, natural antibiotics, Staphylococcus aureus, antimicrobial resistance, skin infections, and cinnamon bark..

INTRODUCTION

The human species is home to a vast array of microorganisms, most of which are considered normal flora and rarely cause illness. However, certain microorganisms that are along the way significant disease-causing agents typically start off as part of the regular flora, which leads to an illness. According to Indonesia's 2011 health profile about the top 10 hospital-acquired diseases, infectious diseases rank highly, with pneumonia coming in at number ten and diarrhea at number one. Bloodstream infections (BSI) are among the many infections that are mostly caused in Escherichia coli with Staphylococcus aureus cause Staphylococcus humans. The common flora that resides on human skin and mucosa includes aureus. Staphylococcus aureus is the causative agent Regarding infections of the skin and soft tissues, surgical site infections, bone and joint infections, hospital-acquired bacteraemia (HAB), and hospital-acquired respiratory infections. When it comes to dangerous germs that having been cut off from individuals receiving treatment in US hospitals, Staphylococcus aureus ranks second among those treated outside of hospitals. The large intestine is often colonized by Escherichia coli, a gram-negative bacterium that takes the form of bacilli. About 90% of gastrointestinal, systemic, and urinary tract infections in humans are caused by the primary pathogen Escherichia coli.

New discoveries of antibacterial agents have become extremely important due to the high incidence of antimicrobial resistance (AMR) brought about by antibiotic abuse. These agents are thought to be one of the pillars of modern medical science in preventing millions of premature deaths caused by infectious diseases, especially bacterial infections. One flavor-enhancing ingredient that is frequently utilized in both the industrial and culinary domains is cinnamon (Cinnamon sp.). Other uses for cinnamon include providing meals a sweet flavour and a unique scent. Because cinnamon possesses antibacterial, antioxidant, and anti-carcinogenic properties, it is widely employed in the medical and cosmetics industries.

oil is coumarin (13.39%), eugenol (17.62%), and cinnamaldehyde (60.72%) which have antibacterial effects Cinnamomum burmannii is among the many varieties of cinnamon. Since the Dutch era, cinnamon has grown significantly in Indonesia and has even emerged as one of the key commodities traded there. The presence of mountainous terrain with sufficient rainfall that runs around the islands of Sumatra, Java, and Sulawesi is conducive to the establishment of Cinnamomum burmannii in Indonesia. There is currently a lot of research on the use of cinnamon plants as medicinal herbs, particularly with regard to their ability to fight microbial infections in both humans and plants. Cinnamon's antimicrobial properties have been investigated against a variety of harmful bacteria, such as Escherichia coli and Staphylococcus aureus.

The presence of cinnamaldehyde, alkaloids, flavonoids, eugenol, coumarin, steroids, saponins, tannins, and phenols is linked in relation to the antibacterial action. The primary component of essential cinnamon. A popular spice plant grown for its fragrant bark, essential oils, and therapeutic qualities is cinnamon (Cinnamomum spp.). Nevertheless, it is susceptible to a number of plant diseases, such as skin illnesses brought on by bacteria, viruses, and fungi. The quality and quantity of cinnamon produced can be greatly impacted by

these illnesses, costing growers' money. Since the bark of the plant is the component that is most valued for commerce, skin infections in cinnamon plants typically show up as lesions, discolouration, cracking, or rotting on the bark. Phytophthora, Colletotrichum, and Pythium are three of the most frequent genera of fungi that cause these illnesses. Because these viruses prefer warm, humid climates, which are typical of areas where cinnamon is grown, prevention and treatment are difficult.

Spores dispersed by the wind, water, or contaminated objects are typically the main source of illness. Once the infection has penetrated the plant's surface, it may spread to other sections of the plant or serve as a point of entry for other pathogenic organisms, which would hasten the plant's demise. The appearance of sunken, black patches on the bark, sap leakage, and, in extreme situations, the plant's eventual death are some of the symptoms.

Good agricultural techniques, like optimal spacing, sanitation, and the use of resistant cultivars, must be combined with the use of appropriate fungicides or biocontrol agents to effectively manage skin diseases in cinnamon. To stop infections from spreading across plantations, early detection and timely treatment are essential.

Figure 1: Cinnamon quilla

Figure 1:Cinnamon flower

Figure 1: Cinnamon leaves and seeds

History of Cinnamon:

Cinnamon has been used since approximately in 2800 BC, it was first called "Kwai" in Chinese. It was a part of the anointing oil that Moses used for the biblically described anointing (the act of making holy). The respiratory and digestive systems ailments were treated with it by the Romans due to its therapeutic qualities. Additionally, it was utilised to prevent the smell of dead bodies during Roman funerals. It was utilised in Egypt for its flavouring and smell, as well as for embalming mummies.

But since it is so valuable and costly, the 15th century saw a global exploration due to the hunt for cinnamon. Vasco da Gama's expedition of Sri Lanka and South India as well as Christopher Columbus's trip that resulted in the finding of a new planet were both driven by this motivation. Later on, it was found that the native of real Cinnamon, sometimes known as Ceylon cinnamon, was a native of Ceylon, a region of Sri Lanka. As such, it was It is obvious that any nation which had the power to take over that region, controlled the global cinnamon trade, and would eventually make enormous profits. As a result, over time, the Portuguese came to power, were surpassed by the Dutch, and were eventually taken over in 1815, by the British. It is currently grown in Sri

Lanka adjacent to the Negombo to Matara coastal strip. Portuguese conquistadors found C. zeylanicum growing profusely in Sri Lanka in the sixteenth and seventeenth centuries, and they brought the spice to Europe. Cinnamon was first cultivated in Java throughout the 17th-century Dutch occupation and the East India Company emerged as the primary exporter of cinnamon to Europe. Despite a decline in the cultivation of Ceylon cinnamon, Ceylon cinnamon oil is still mostly sourced from Sri Lanka, and the food and medicinal industries make extensive use of this oil. Chinese cinnamon oils are extensively employed in the medical field.

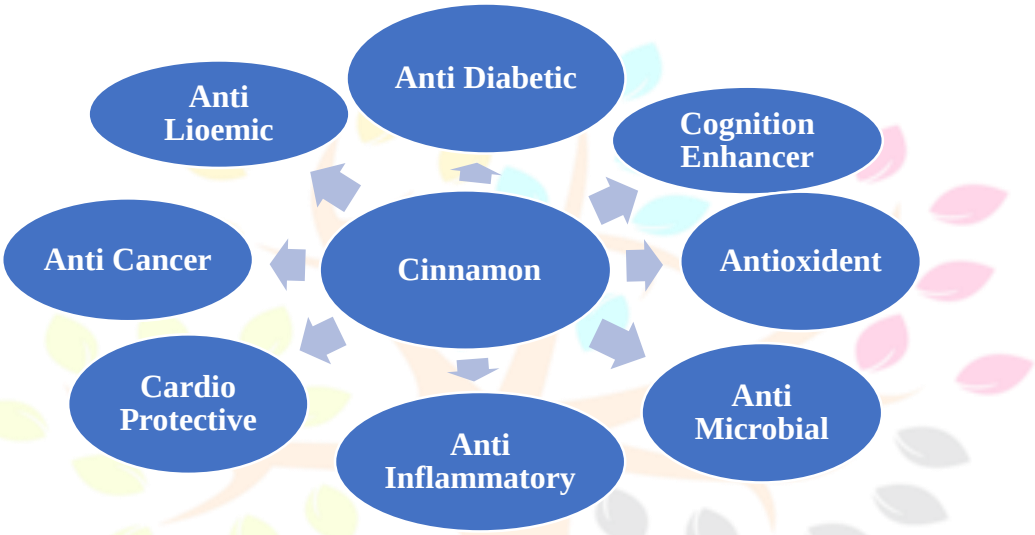

Figure 2: Cinnamon's pleiotropic effects

Types of Cinnamon:

Four primary varieties of Cinnamon exist:

Cinnamomum zeylanicum, sometimes known as true cinnamon, Mexican cinnamon, sometimes known as Ceylon cinnamon, is one of the active ingredients includes linalool, cinnamaldehyde, and eugenol.

Possible Skin Benefits: Compared to Cassia, Ceylon cinnamon has more potent antioxidant and antibacterial qualities. Because of its capacity to destroy microorganisms, it may aid during the course of treating, bacterial infections, fungal infections, and acne.

Applications in Skin Care: To treat mild skin infections, ground Ceylon cinnamon or its essential oil is frequently incorporated into pastes, balms, or diluted solutions. In comparison to Cassia cinnamon, it is kinder to the skin.

Cinnamomum aromaticum sometimes known as Chinese cinnamon, or cassia cinnamon.

Active Components: Has greater levels of cinnamon aldehyde and coumarin.

Possible Skin Benefits: Compared to Ceylon cinnamon, Cassia cinnamon is rougher on the skin but possesses antibacterial qualities as well. In high quantities, it may irritate skin yet is helpful against bacterial and fungal infections.

Applications in Skin Care: Distilled properly, carissa cinnamon powder or oil can be used as a topical therapy. For ailments like fungal infections or acne, it might work well.

Cinnamomum burmanni, or Indonesian cinnamon, The cinnamon from Vietnam (Cinnamomum loureiroi)

Cinnamomum zeylanicum	**Cinnamomum burmanni**	**Cinnamomum loureiroi**	**Cinnamomum aromaticum**
Sri Lanka	Indonesia	Vietnam	China
Slightly sweet	Spicy	Spicy and brown	Spicy but bitter
Light to medium reddish brown	Dark reddish brown	Dark reddish brown	Dark reddish brown
Lower coumarin content	Cheap**,** high coumarin, strong aroma	Strong aroma, spicy, high coumarin	High coumarin, very strong taste

Classification of selected bacterial skin infection

Disease	Common agent
• **Primary**	
1. Impetigo	1) S. aureus**,** streptococcus pyogenes.
2. Cellulitis and arysipelas	2) Group A streptococci.
3. Staphylococcal scaled skin syndrome	**3)** S. aureus
4. Folliculitis	4) S. aureus
• **Superficial folliculitis**	
1. Staphylococcal folliculitis	1) S. aureus
2. Gram negative folliculitis	2) Kiebsiella, Pneumonia, Enterobactor Proteus vulgaris.
3. Propionibacterium acne Folliculitis Deep folliculitis	3) Propionibacterium acne
4. Sycosis baebae	4) S. aureus
5. Furuncles or Carbuncles	5) S. aureus
6. Pitted keratolysis	6) Gram positive caryneforms
• **Secondary**	
1. Intertrigo	1) Over growth of resident end transient bacteria
2. Eczematoid dermatitis	2) S. aureus
3. Tec web infection	**3)** Fungi, corynoform bacteria.

Properties: Antibacterial properties

a. Battle difficult-to-treat bacterial organism: A study that employed bacterial culture and laboratory testing discovered that components in cinnamon oil possessed an antibacterial action against a drug-resistant, potentially fatal bacteria that affects people, plants, and other animals.

b. Promote oral health: It has been discovered that cinnamon's antibacterial and antifungal qualities are effective against Streptococcus mutants and on Candida sap Biofilm, two substances that lead to dental cavities and oral infections.

c. Disinfectant: Due to its antimicrobial qualities, cinnamon bark oil is a non-chemical, safe, and effective substitute for additives that able can be applied to prolong the shelf life of goods. According to one study, cinnamon oil works well as a disinfectant in medical environments and as a preservative cosmetic.

MATERIAL AND METHOD

1. Contents

We imported cinnamon bark and forest honey from Indonesia. The other chemicals and the reflux apparatus were analytical grade. Propionibacterium acnes and Staphylococcus epidermidis were the test bacteria, and they were taken from the culture collections of the Microbiology Laboratory at the Schoolof Pharmacy, Bandung Institute of Technology, Bandung, Indonesia**.**

2. Antimicrobial Properties of Agar Diffusion

An agar diffusion method was used to investigate the antimicrobial properties of the mixture of all constituents on solid media (Balouris et al. 2016). The antibiotic activity of the bacterial strains linked to skin infections was tested using Muller Hinton agar (MHA). Using a sterile swab, the bacterial inoculum (0.5 McFarland turbidity) was evenly distributed on MHA plates. Sterile cork borer wells with a 7mm diameter were used to puncture the agar. The mixture was added to each well at different concentrations (1/2, 4 mg/mL), and the wells were then incubated for 24 hours at 37°C.

Vancomycin (Hikma Pharmaceutica) for gram-positive bacteria and penicillin (PANPHARMA) for pseudomonas aeruginosa were utilised as controls. Each extract's zone of growth inhibition was measured following incubation.

Antibacterial activity mechanisms

Modifications to the lipid composition and cell membrane

Because Gram-negative bacteria have more complex cell walls than Gram-positive bacteria, they are typically more resistant to plant extracts, oils, and their components. Gram-negative bacteria are more resistant because porin proteins act as hydrophilic transmembrane channels for small hydrophilic solutes, which readily flow through the outer membrane of the bacteria. Hydrophobic antibiotics, on

the other hand, find it difficult to enter the cell. Hydrophobic compounds are easily able to permeate andoperate on both the cell wall and the cytoplasm of Gram-positive bacteria.

Method for extracting Cinnamon oil

1. **Steam Distillation**

   The most popular technique for obtaining essential oils, such as cinnamon oil, is this one. **Method:** Steam is directed via leaves or the bark of cinnamon. The essential oils in the steam evaporate, and the steam then condenses back into a liquid. It is feasible for gather the essential oil when it separates from the water.

   Advantages: Generates superior essential oil, ideal for industrial manufacturing.

   Cons: May need a lot of energy and specific equipment**.**

2. **Pressing Cold**

   A method called cold pressing is one that is more frequently employed for citrus oils than for cinnamon. It entails mechanically pressing the plant material to extract its oils. **Procedure:** Pressing the cinnamon bark is how this process gets the oil out. Because steam distillation is a more effective method for processing spices like cinnamon, it is less popular. **Advantages:** Delicate substances are preserved because no heat is applied.

   Cons: Usually used for citrus fruits; less effective for cinnamon**.**

3. **Extracting Solvents**

   Essential oils from plants where steam distillation is less successful are extracted using this method**.**

   Method: To dissolve the essential oils, cinnamon bark is treated with a solvent (such as hexane). After that, the concentrated it leaves behind oil. When the solvent evaporates**.**

   Benefits: Provides a greater output of essential oil.

   Drawbacks: Using solvents may leave trace residues in the finished product, which not all applications will want.

4. **Extraction of CO2**

   This technique extracts essential oils by applying high pressure to carbon dioxide.

   Method: To remove the oils from cinnamon bark, high pressure and low temperature are applied to CO2 as a solvent. After that, the pure oil is extracted along with the CO2.

Benefits: Produces pure essential oil of superior quality while holding onto a variety of components.

Cons: May be expensive and requires specialized equipment**.**

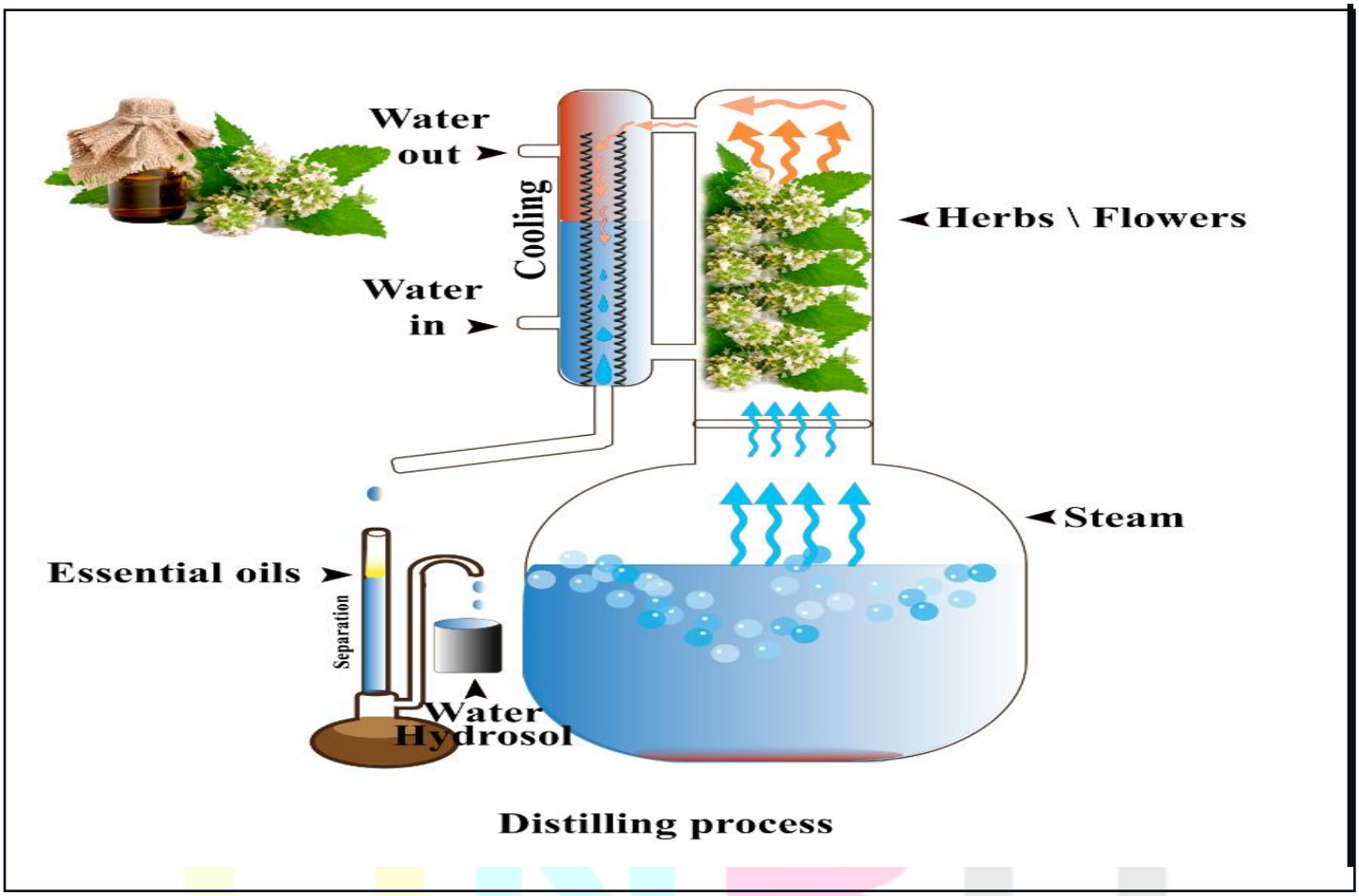

Figure 3: Essential Oil Cinnamon

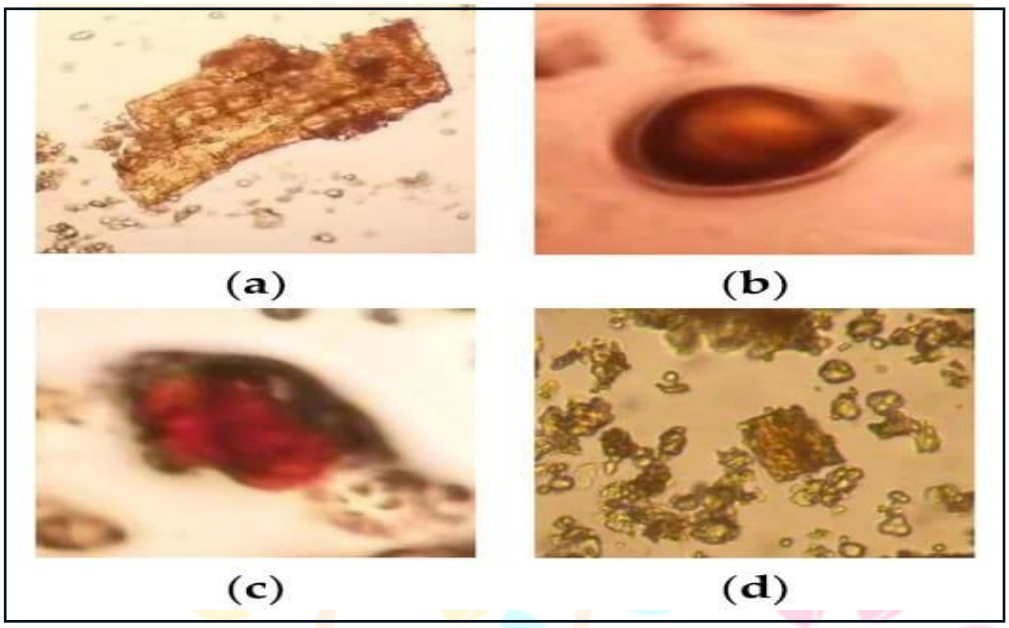

Figure 4: Microscopic examination of powdered cinnamon sp. bark at a 100x magnification

(a) Parenchym cells holding starch; (b) Resin cells; (c) Cells containing material that is reddish-brown; and (d) Cells containing crystals.

Treatments

The course of action is determined by the infection's intensity and an etiology.

Certain infections are self-limiting or respond well to over-the-counter creams.

A doctor may recommend treatment such as the following if an illness is severe, the patient is at risk of consequences, or the infection is communicable.

1 Medication

2 Antivirals

3 Fungicides

4 Inhibitors of parasites

Conventional Applications

Since ancient times, cinnamon has been recognized as among the most popular spices and food flavouring enhancers. For example, because of the delightful and revitalizing sensation that it generates in the tongue, it has been utilised as a flavour in candies and chewing gum. It's also applied to treat toothaches, dental infections, and poor breath, and it has positive impacts on oral health. The therapeutic use of aromatherapy application Numerous essential oils from plants that can enter the body through the skin or olfactory system, cinnamon essential oil may also be utilised.

Side effects of Cinnamon

Allergies and irritation: Cinnamon often has no negative effects. However, frequent usage might aggravate your lips and mouth, leading to ulcers. It causes allergies in certain persons. If you apply it to your skin, it could irritate and cause redness.

Toxicity: Consuming a lot of cassia cinnamon, particularly in case you have liver issues, may be harmful. Although the amount of coumarin that some cinnamon products contain is so minimal that it probably won't cause any difficulties, the substance can cause problems with the liver. Because there is insufficient information regarding the safety of cinnamon, it is not recommended for use as a therapy in children, pregnant women, or nursing mothers.

Reduce blood sugar: If you take cinnamon supplements and have diabetes, you may need to modify your treatment interactions because it may have an effect on your blood sugar. Consult your doctor before beginning to use supplements containing cinnamon Should you take any medications on a daily basis. Antibiotics, diabetes medications, blood thinners, heart medications, and other medications may be affected.

CONCLUSION

It's been proven that cinnamon bark, or Cinnamomum verum, is effective against certain microorganisms that cause skin infections, such as Pseudomonas aeruginosa, Staphylococcus aureus and Escherichia coli. Eugenol and cinnamon aldehyde, two active substances that stop some germs from growing and spreading, improve the product's antibacterial properties. The results of several studies point to the potential use of cinnamon bark as a natural remedy or adjunctive medication for the purpose of treating skin infections. Its effectiveness, low toxicity, and natural origin make it a viable a substitute for artificial antibiotics, particularly in light of the rising incidence of antibiotic resistance.

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