

Original Research Article

Isolation and identification of pathogenic bacteria in the Batanghari River, Jambi

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ABSTRACT

Research on the isolation and identification of pathogenic bacteria in the Batanghari River, Jambi, was conducted from November to February 2023. The purpose of this research was to identify pathogenic bacteria in the Batanghari River, Jambi. The research method involved purposive sampling in the field and bacterial identification tests in the laboratory. Samples from the field were diluted, inoculated, and incubated on Nutrient Agar (NA) media for 24 hours. Macroscopic observations included the shape, color, elevation, texture, and surface of the bacterial isolates. Microscopic observations included the bacterial cell shape and characteristics in Gram staining. The research results showed the presence of pathogenic bacteria from the *Vibrio cholerae* group.

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1. INTRODUCTION

The availability of water sources is highly beneficial for drinking, agricultural activities, inland fisheries, hydroelectric power generation, sanitation, industrial activities, urban development, and other human activities. Given its crucial role, the availability of clean water sources must be taken into consideration. Domestic and industrial waste is usually discharged into rivers located near settlements and industrial areas. Indirectly, these rivers receive hazardous waste, which alters their original functions. If an industrial activity lacks proper waste management systems, industrial waste is directly discharged into the river, resulting in pollution. According to Dwidjoseputro (1990), water pollution caused by viruses, pathogenic bacteria, parasites, or chemicals can occur in both raw water sources and during the distribution of treated water from processing centers to consumers. The availability of good-quality water sources is scarce due to the lack of public concern for water pollution. One microbiological pollution that occurs in water bodies is the abundance of coliform bacteria and microorganisms indicating contamination by pathogenic bacteria such as *Escherichia coli*. Therefore, it is necessary to examine bacterial content in water bodies used for water management and to manage waste disposal for industrial and household activities. The higher the coliform content in a water body, the higher the presence of other pathogenic bacteria, which can cause health problems for humans using that water source for various activities. Additionally, these pathogenic bacteria can contaminate the aquatic organisms inhabiting the water body.

The Batanghari River, which crosses the provinces of West Sumatra and Jambi, contains gold deposits, particularly in the upstream areas in West Sumatra. The Batanghari River is widely used for daily needs such as irrigation, water transportation, and fisheries. However, the current issue is the pollution that has occurred in the Batanghari River. Considering the less clean condition of the Batanghari River and its use as a central hub for activities of communities living along its banks, such as bathing and laundry, it poses a significant danger to the surrounding population and allows microorganisms to thrive in the river.

Based on a study conducted by Aldino (2015:31) on bacterial identification in the Batanghari River in the Penyengat Olak area of Muaro Jambi Regency, Jambi Province, six isolates were obtained: *Actinomyces*, *Clostridium*, *Bacillus*, *Streptococcus*, *Shigella*, and *Dermatophilus*. The purpose of this research was to identify the pathogenic organisms present in the surface water of the Batanghari River in Jambi.

2. METHODS

The research was conducted in the Batanghari River, specifically at Aurduri 1 bridge. This location is densely populated and involves activities such as sand mining and wood processing. The research design employed was descriptive research with purposive sampling technique in the Batanghari River, Jambi. The bacterial isolation method used was the pour plate method.

2.1 Tools and materials

The equipment used in this research included droppers, Erlenmeyer flasks, analytical balances, spatulas, stirring rods, petri dishes, an incubator, a Bunsen burner, glass slides, a microscope, and a Laminar Air Flow (LAF) cabinet. The materials used were Batanghari River water, distilled water, Nutrient Agar (NA) media, and alcohol.

2.2 Water Sampling

Water samples, as the source of isolates, were collected and stored in sterilized sample bottles. The bottles were immediately sealed and transported to the laboratory for further processing.

2.3 Production of Growth Media (NA)

The growth medium used in this research was nutrient agar. Nutrient Agar media was weighed 8g and then mixed with distilled water 250ml. The mixture was heated on a hotplate until it boiled. The cooked agar was then put into an autoclave for sterilization using high-pressure steam to minimize the risk of contamination.

2.4 Isolate Planting on Media NA

The collected water samples were directly inoculated onto the poured Nutrient Agar media in petri dishes. The pour plate method was used for sample isolation, with 1ml of the sample isolate.

2.5 Isolate incubation

The inoculated samples were incubated for 24 hours in an incubator at a temperature of 37°C.

3. RESULTS AND DISCUSSION

The observation of bacterial isolates derived from the Batanghari River in Jambi yielded the following macroscopic characteristics: pinpoint size, opaque appearance (not transparent to light), irregular shape, raised elevation, smooth shiny surface, and undulate margins.



Figure. 1 Macroscopic Appearance of Bacterial Isolates (Personal Documentation, 2022)

Due to the macroscopic characteristics, the exact type of bacteria obtained from the isolate cannot be determined. Therefore, microscopic observations were conducted to examine the microstructure of the bacteria. Under the microscope, the observed bacterial shape resembled a vibrio, indicating that the obtained isolate belongs to the *Vibrio sp.* group.



Figure. 2 Microscopic Appearance of Isolates (Personal Documentation, 2022)

Vibrio is a gram-negative, curved rod-shaped (comma-shaped) bacterium that is facultatively anaerobic and lives in salty water. It does not form spores and shows positive oxidase reactions. All members of this bacterial group are actively motile, with flagella at the ends of their cells, and have a sheath. Some species of *Vibrio sp.* are pathogenic and often cause gastroenteritis (Soedarto, 2015). Common symptoms include abdominal pain, watery or bloody diarrhea, nausea, vomiting, fever, chills, headache, and dehydration. The incubation period for *Vibrio cholerae* is 1-3 days, while for *Vibrio parahaemolyticus*, it is 2-48 hours (Rahayu, 2011). *Vibrio sp.* is the most commonly found bacteria on the surface of water worldwide and can be found in shallow water bodies and oceans (Jawetz, 2012).

Kingdom : Bacteria

Phylum : Proteobacteria

Class : Gammaproteobacteria

Ordo : Vibrionales

Family : Vibrionaceae

Genus : *Vibrio*

Species : *Vibrio cholerae*, *Vibrio parahaemolyticus*, *Vibrio vulnificus*, *Vibrio fluvialis*, *Vibrio mimicus*, *Vibrio hollisae*, *Vibrio damsela*, *Vibrio anguolyticus*, *Vibrio metschnikovii* (Jawetz, 2007).

According to Dwiyatmo (2007:12), water pollution refers to changes in the condition or state of a water disposal site, such as lakes, oceans, rivers, and groundwater, caused by human activities. There are numerous factors and causes of water pollution, but in general, there are two processes: direct and indirect water pollution. Direct water pollution has a toxic impact due to the presence of pollutants that can harm human health, plants, animals, soil, air, and disrupt the ecological balance of water quality. Indirect pollution occurs when various chemical substances react in the air, soil, or water, leading to contamination. Some pathogenic microorganisms that can pose health risks include bacteria commonly found in water polluted by human and animal feces, such as *Escherichia coli*, fecal *Streptococcus*, and *Clostridium perfringens*.

Among the pathogenic *Vibrio* bacteria, *Vibrio cholerae* and *Vibrio parahaemolyticus* are notable (Soedarto, 2015). *Vibrio cholerae* reproduces and spreads through human feces. If feces containing this bacterium contaminate rivers or other water sources, individuals who come into contact with the contaminated water are at risk of contracting cholera. *Vibrio cholerae* is the etiological agent of cholera. It can infect humans through the fecal-oral route (Guntina and Kusuma, 2016). Clinical manifestations of cholera occur when the number of bacteria ingested reaches a certain threshold, which is influenced by the process of entry into the gastrointestinal tract. An individual with normal stomach acid can be

infected by ingesting 10¹⁰ or more *V. cholerae* in water (10³-10⁶ in water) and 10²-10⁴ organisms if ingested with food.

Cholera is a diarrheal disease that causes significant morbidity and mortality worldwide. It is an intestinal infection caused by the bacterium *Vibrio cholerae*. Cholera can be transmitted through contaminated food, beverages, or contact with cholera carriers. In the small intestine, *Vibrio cholerae* acts by releasing toxins into the intestinal tract, leading to acute and severe diarrhea accompanied by vomiting (Sawasvirojwong, Srimanote, Chatsudthipong, et al., 2013). Preventing and interrupting the transmission of cholera relies on environmental sanitation principles, especially ensuring clean water and proper feces disposal that meets environmental standards (Anggaraditya, 2015). Other preventive measures include boiling drinking water, thorough handwashing with soap or antiseptics before eating, washing vegetables with clean water, especially raw vegetables (salad), and avoiding consumption of partially cooked fish and shellfish. If a family member is affected by cholera, they should be isolated and promptly receive treatment (WS et al., 2013). Objects contaminated with vomit or feces should be sterilized, and insect vectors, such as flies, should be eradicated. Cholera vaccination can protect individuals in direct contact with patients. In the pathogenesis of bacteria causing diseases, there are generally two stages

4. CONCLUSION

The result of bacterial isolation from the Batanghari River in Jambi revealed the presence of *Vibrio* sp, which is a group of pathogenic bacteria that can cause cholera.

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