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INTEGRATION OF ISLAMIC ETHICAL PRINCIPLES INTO BUSINESS STRATEGIES OF SUSTAINABLE ECONOMIC SYSTEMS

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CIRCULAR ECONOMY AND ISLAMIC ETHICAL PRINCIPLES

ISRAF

Prohibition of wastefulness

KHALIFA

Human responsibility as steward of the Earth

MIZAN

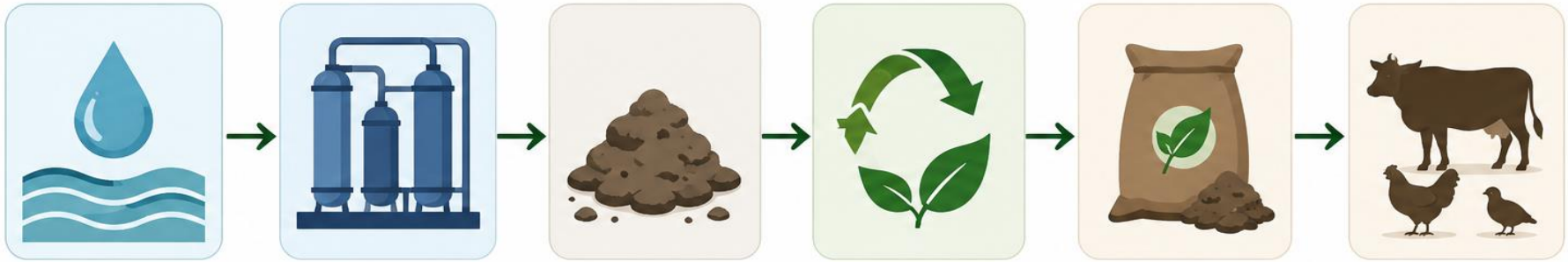
Balance in nature

TAYYIB

Purity and safety of products

The integration of Islamic ethical principles with the circular economy promotes **responsible resource use, environmental protection**, and the development of **sustainable and halal production systems**.

PROCESS AND RESEARCH FOCUS



RAW SALINE WATER

Collection of saline water from the source.

PURIFICATION PROCESS

Removal of impurities and suspended particles.

MINERAL SLUDGE (BY-PRODUCT)

Sludge generated during the purification process.

VALORIZATION

Transformation of mineral sludge into a valuable secondary raw material.

SECONDARY RAW MATERIAL

Processed sludge suitable for use in animal feed formulations.

ANIMAL FEED APPLICATION

Safe and effective use of the material in animal feed.

CLOSING THE LOOP – REDUCING WASTE, CREATING VALUE

This process represents an integrated approach to transforming waste from water purification into a valuable resource for the animal feed industry. By closing the loop, we contribute to **waste reduction, resource efficiency**, and the development of **sustainable and halal production systems**.

EXPECTED CONTRIBUTIONS

WASTE REDUCTION

Minimizing waste generated in purification processes.

RESOURCE REUSE

Transforming by-products into valuable resources.

POTENTIAL FOR ANIMAL FEED

Mineral sludge as secondary raw material for animal feed.

ALIGNMENT WITH HALAL PRINCIPLES

Supporting ethical and sustainable halal production.

SUSTAINABILITY

Contributing to environmental protection and sustainable development.

These contributions help create a circular and sustainable production system that **reduces environmental impact**, makes **efficient use of resources**, and supports the **development** of a **responsible and ethical halal industry**.

MATERIALS AND METHODS

SAMPLE COLLECTION AND PREPARATION

Sludge collected from the contact bed reactor during raw saline water purification.

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Sludge (in liquid state) was left to settle for natural sedimentation and phase separation.

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The upper purified saline water layer was carefully decanted.

↓

The remaining mineral-rich phase was transferred to a filter press for mechanical water removal and sludge cake formation.

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The sludge cake was dried at 110 °C for 1 hour to remove residual moisture and stabilize the material.

PHYSICOCHEMICAL AND SPECTROSCOPIC ANALYSIS

Standard laboratory physicochemical methods were applied.

Determination included:

- Mineral composition
- Moisture content
- Basic chemical characteristics

FTIR (Fourier Transform Infrared Spectroscopy) analysis was performed:

- Instrument: IR Spirit infrared spectrophotometer
- Wavenumber range: 4000–400 cm^{-1}

SAFETY ASSESSMENT

Heavy metal analysis was conducted to evaluate suitability for animal feed application.

DATA INTERPRETATION AND APPLICATION

Results were analyzed using qualitative and comparative methods.

Particular emphasis was placed on integration into **sustainable** and **halal** production systems based on **circular economy principles.**

EXPERIMENTAL FLOW

Sampling from contact bed reactor →

Settling and phase separation →

Decantation of purified water →

Filtration and sludge cake formation →

Drying at 110 °C for 1 hour →

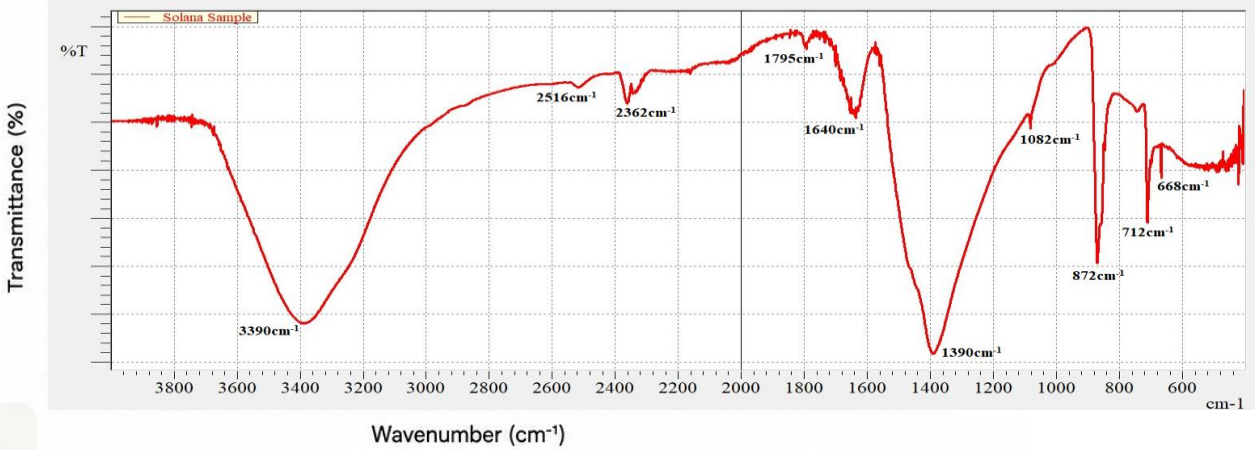
Prepared dry sludge sample for analysis

RESULTS AND DISCUSSION

PHYSICOCHEMICAL AND FTIR ANALYSIS

- Physicochemical analyses showed a stable mineral composition, indicating the potential for further technological valorization of the sludge.
- FTIR analysis was performed using an IR Spirit infrared spectrophotometer in the wavenumber range of 4000 to 400 cm^{-1}.

FTIR SPECTRUM OF THE ANALYZED SAMPLE



INTERPRETATION OF FTIR RESULTS

- Predominantly calcium carbonate ($CaCO_3$) structure.
- Peaks characteristic of $CaCO_3$ at: 712, 872, 1082, 1390, 1795, and 2516 cm^{-1}.
- Presence of water confirmed by peaks at 3390 and 1640 cm^{-1}.
- Peak at 2362 cm^{-1} indicates CO_2 from air.
- Subtle peak at 668 cm^{-1} likely originates from compounds containing chlorine.

HEAVY METAL CONTENT ANALYSIS

The most commonly identified metals in sludge from raw saline water are lead (Pb), cadmium (Cd), mercury (Hg), arsenic (As), chromium (Cr), nickel (Ni), copper (Cu), and zinc (Zn). These elements have a pronounced toxic potential, accumulate in sediments, and pose a risk to the environment and human health if they enter the food chain.

Table 1. Presentation of the presence and concentration data of heavy metals

No.	Parameter	Result	Unit
1.	Arsenic (As)	0.000	mg/kg
2.	Copper (Cu)	0.000	mg/kg
3.	Mercury (Hg)	48.44	µg/kg
4.	Zinc (Zn)	5.182	mg/kg
5.	Iron (Fe)	238	mg/kg

The analysis of heavy metal content showed **concentrations below the maximum permissible limits** prescribed by relevant safety standards, thereby confirming the possibility of its **potential application in animal feed.**

RESULTS AND DISCUSSION

POTENTIAL APPLICATION AND CIRCULAR ECONOMY

- The analyzed sludge may have a significant role as a secondary raw material in circular production systems. Calcium carbonate is widely used as a mineral supplement in animal feed, and the high proportion of this compound confirms the potential practical application of the material.

ISLAMIC ETHICAL PRINCIPLES AND SUSTAINABILITY

- This approach represents responsible resource management in accordance with the principles of *israf* and *khalifa*.
- Sustainable financial strategies and ESG criteria integration enable organizations to attract sustainable investments and develop business models based on green economy principles.
- Valorization of sludge can reduce waste management costs and create additional economic value.

GREEN TECHNOLOGY AND SUSTAINABLE INNOVATION

- Green technology and sustainable innovation are key to the transition toward sustainable industrial systems.
- Technologies such as EMAS (Eco-Management and Audit Scheme) enable organizations to assess and improve their environmental impact through continuous monitoring and implementation of standards.
- The integration of green technologies with halal and *tayyib* principles contributes to the development of safer, more competitive, and more sustainable production models.

RESOURCE REUSE AND TAYYIB PRINCIPLE

- Reusing by-products instead of disposing of them as waste reduces negative environmental impacts and promotes the rational use of natural resources.
- The concept of *tayyib* emphasizes the importance of product safety and quality, which has been confirmed by the results of the analyses.

OVERALL IMPLICATION

- The integration of Islamic ethical principles with the circular economy concept can contribute to the development of more sustainable production models in the halal industry.
- Besides environmental benefits, this approach can also bring significant economic effects through waste cost reduction and the creation of new value from industrial by-products.

CONCLUSION

The research results showed that the sludge generated during the purification process of raw saline water possesses **significant potential for valorization** within circular production systems. The analyses confirmed a **stable mineral composition** and **heavy metal concentrations below the permissible limits**, indicating the possibility of its **safe application in animal feed**.

The dominant content of **calcium carbonate** confirms the potential use of the analyzed material as a **calcium source** in the animal feed industry, whereby an industrial by-product is transformed into a useful secondary raw material. In this way, the fundamental principles of the **circular economy** are achieved through **waste reduction** and **more efficient resource utilization**.

The integration of **Islamic ethical principles** such as the prohibition of wastefulness (*israf*), preservation of natural balance (*mizan*), and responsible resource management (*khalifa*) with modern concepts of sustainable development may represent an important model for the development of the future halal industry.

Such an approach contributes not only to **environmental and economic sustainability**, but also to the development of **ethically responsible production systems** based on the principles of safety, quality, and social responsibility.

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THANK YOU FOR ATENTION

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