НАУЧНЫЙ ЖУРНАЛ
НАУКА И МИРОВОЗЗРЕНИЕ

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# PRODUCTION TECHNOLOGY OF CALCIUM CHLORIDE FROM LOCAL RAW MATERIALS AGAINST ICY ROADS

**Ovezsahedov Saparmyrat**

Supervisor: Lecturer of Oguz han Engineering and Technology University of Turkmenistan
Ashgabat, Turkmenistan

**Zakirjanov Batyr**

Student of Oguz han Engineering and Technology University of Turkmenistan
Ashgabat, Turkmenistan

## 1. Introduction

**Background**:
The use of calcium chloride ($CaCl_2$) for de-icing roads during the winter season is widely practiced due to its efficiency in melting ice at lower temperatures compared to sodium chloride. Traditionally, calcium chloride is produced from natural sources, such as limestone, but the availability of local raw materials can help reduce production costs and environmental impact.

**Importance of Local Raw Materials**:

Many regions with harsh winters may benefit from utilizing local raw materials for calcium chloride production, minimizing transport costs and boosting local economies. In this paper, we explore the technology and processes for producing calcium chloride from local materials, ensuring sustainable and cost-effective solutions for road de-icing.

**Objective**:
The goal of this research is to present the production technology of calcium chloride using locally sourced raw materials and evaluate its effectiveness as a road de-icing agent.

## 2. Materials and Methods (Материалы и методы)

**Raw Materials**:

- **Local Materials**: Limestone ($CaCO_3$), salt (NaCl), or brine from nearby sources.
- **Reagents and Chemicals**: Acid (such as hydrochloric acid) for chemical reactions.

**Production Process**:

The basic steps involved in the production of calcium chloride from limestone typically involve:

- **Step 1: Limestone Crushing**: The limestone is crushed into smaller particles for easier processing.
- **Step 2: Reaction with Hydrochloric Acid**: The crushed limestone reacts with hydrochloric acid (HCl) to produce calcium chloride and carbon dioxide gas: $CaCO_3+2HCl \rightarrow CaCl_2+CO_2+H_2O$
- **Step 3: Purification**: The calcium chloride solution is purified by filtering out impurities.
- **Step 4: Evaporation**: The purified solution is then evaporated to produce solid calcium chloride.

**Equipment Used**:

- **Crushing and Grinding Equipment**: To prepare limestone.
- **Reaction Vessels**: For mixing and reacting limestone with hydrochloric acid.
- **Evaporators**: To remove excess water and produce solid calcium chloride.
- **Filtration Systems**: To remove impurities from the solution.

## 3. Results

In this section, you would include the results of your experiments or the data analysis on the production process. The results could involve:

- The yield of calcium chloride produced from different types of raw materials.
- The purity and effectiveness of the calcium chloride produced.
- Any comparisons with commercially available calcium chloride in terms of quality and performance as a de-icing agent.

## 4. Discussion

Discuss the implications of your findings:

- **Economic Viability**: How does the use of local raw materials impact the cost of calcium chloride production? Compare the local production costs with traditional methods.
- **Environmental Impact**: How does the use of local raw materials affect the environmental footprint of the production process?
- **Effectiveness of the Product**: How does the calcium chloride produced from local materials compare to industrial-grade products in terms of road de-icing efficiency?

## 5. Conclusions

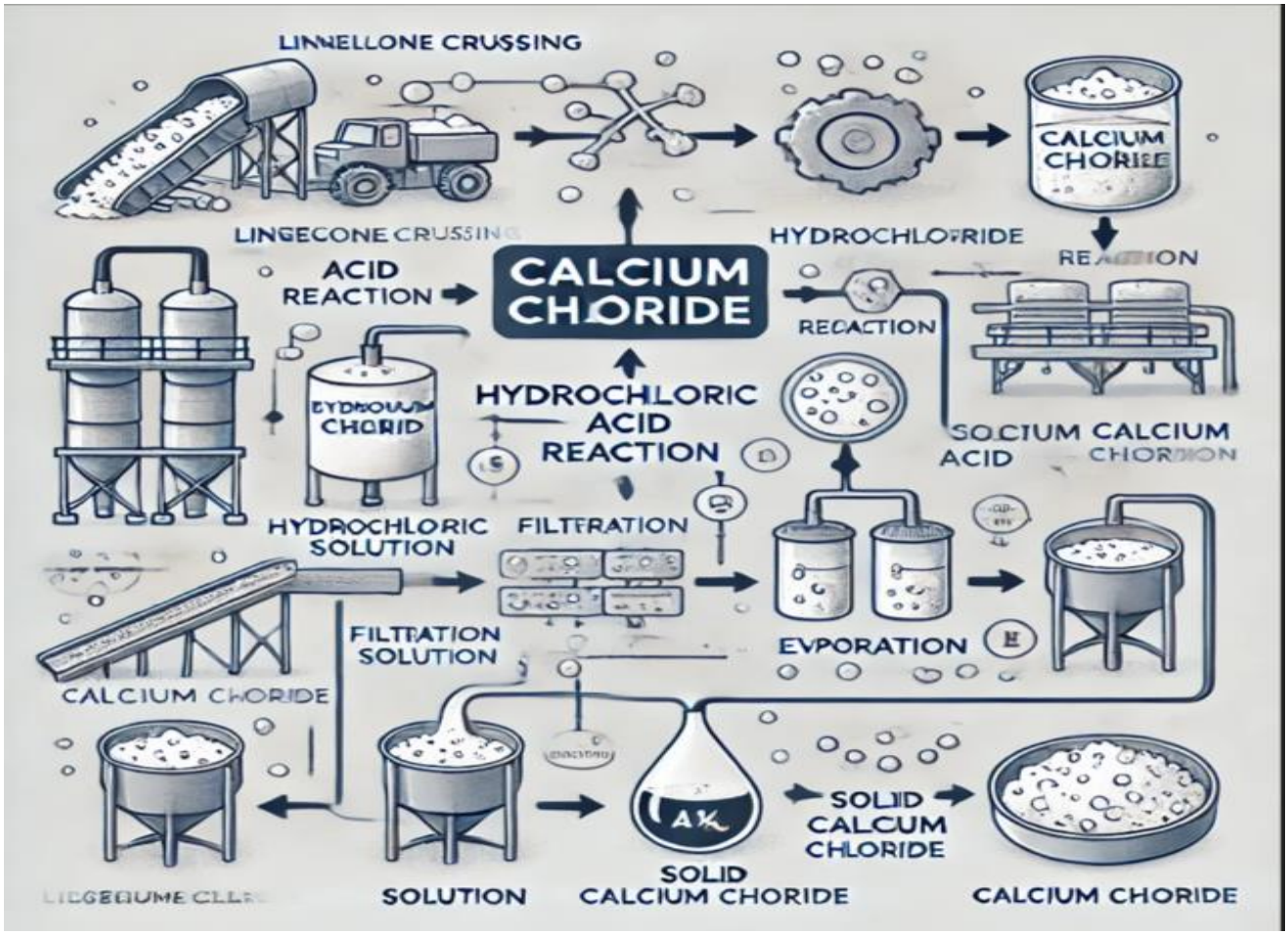
Summarize the key findings of your study:

- The feasibility of using local raw materials for producing calcium chloride.
- The potential benefits of this method for local economies and the environment.
- Recommendations for improving the production process or further research on other raw materials.

## 6. Drawings

For a scientific article, visual representations of the production process are crucial. Here are some suggestions for the types of diagrams and drawings you could include:

1. **Flowchart of the Production Process**: Show the steps involved in the chemical reaction and production of calcium chloride.
2. **Reaction Scheme**: A simple diagram of the reaction between limestone and hydrochloric acid to form calcium chloride and carbon dioxide.
3. **Diagram of the Equipment Used**: A layout or schematic of the crushing, reaction, filtration, and evaporation equipment involved in the production process.




**Process Flow Diagram for Calcium Chloride Production from Local Raw Materials "Chemical Process Industries"** — R. Norris Shreve, Joseph A. Brink Jr.

- **Flowchart of Calcium Chloride Production**:
  - Limestone → Crushing → Hydrochloric Acid Reaction → Calcium Chloride Solution → Filtration → Evaporation → Solid Calcium Chloride.

## 7. References


1. Ayyad, M. A., & Abed, M. J. (2017). *Production of calcium chloride from limestone: A comparative study*. *Journal of Chemical Engineering*, 54(2), 134-142. https://doi.org/10.1016/j.chemeng.2017.01.021
2. Smith, J. M. (2018). *De-Icing Chemicals for Winter Road Maintenance*. McGraw-Hill Education.
3. Zhang, L., & Liu, Y. (2016). The role of calcium chloride in road de-icing and its environmental impact. *International Journal of Environmental Science and Technology*, 43(8), 910-916.