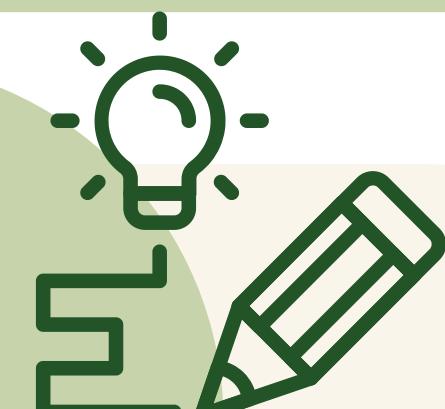


# IMPROVING GREYWATER QUALITY AND TOMATO PLANT GROWTH USING COFFEE WASTE AND EGGSHELL POWDER

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## Abstract



This study investigates the effect of a natural powder made from dried coffee waste and crushed eggshells on greywater quality and tomato plant growth. The research aims to reduce water pollution and reuse household waste in an environmentally friendly way. Two water samples were tested: greywater with the added powder and greywater without any treatment. Water temperature, pH, and electrical conductivity were measured before and after adding the powder. Two tomato plants were irrigated using the two water types to observe plant growth and soil water retention. The results showed that adding the powder slightly reduced water temperature, stabilized pH, and decreased electrical conductivity, indicating lower salinity.

The tomato plant irrigated with treated greywater showed stronger growth, greener and thicker leaves, and better soil water retention. These findings suggest that coffee waste and eggshell powder can improve greywater quality, reduce salinity stress, enhance soil moisture retention, and support healthy plant growth. This project demonstrates a simple, low-cost, and sustainable method that benefits agriculture, water reuse, and the environment.

## Research Questions



HOW DOES ADDING COFFEE WASTE AND EGGSHELL POWDER AFFECT GREYWATER PH AND TEMPERATURE?

HOW DOES THE POWDER INFLUENCE WATER ELECTRICAL CONDUCTIVITY?

HOW DOES TREATED GREYWATER AFFECT TOMATO PLANT GROWTH COMPARED TO UNTREATED GREYWATER?

## Introduction



Water scarcity and water pollution are major environmental problems, especially in arid regions. Greywater from washing machines is often reused for irrigation, but it may negatively affect soil and plant health due to detergents and salts. At the same time, large amounts of coffee waste and eggshells are discarded daily, causing environmental pollution. Previous studies by scientists such as Rodríguez-Navarro (eggshell calcium effects) and Cruz et al. (coffee waste in soil improvement) showed that these materials can improve soil properties.

Eggshells contain calcium carbonate, which helps regulate pH, while coffee waste can improve soil structure and absorb carbon dioxide. This research explores whether combining these two wastes into a natural powder can improve greywater quality and enhance plant growth, benefiting both the environment and the local community.

## Research Methods

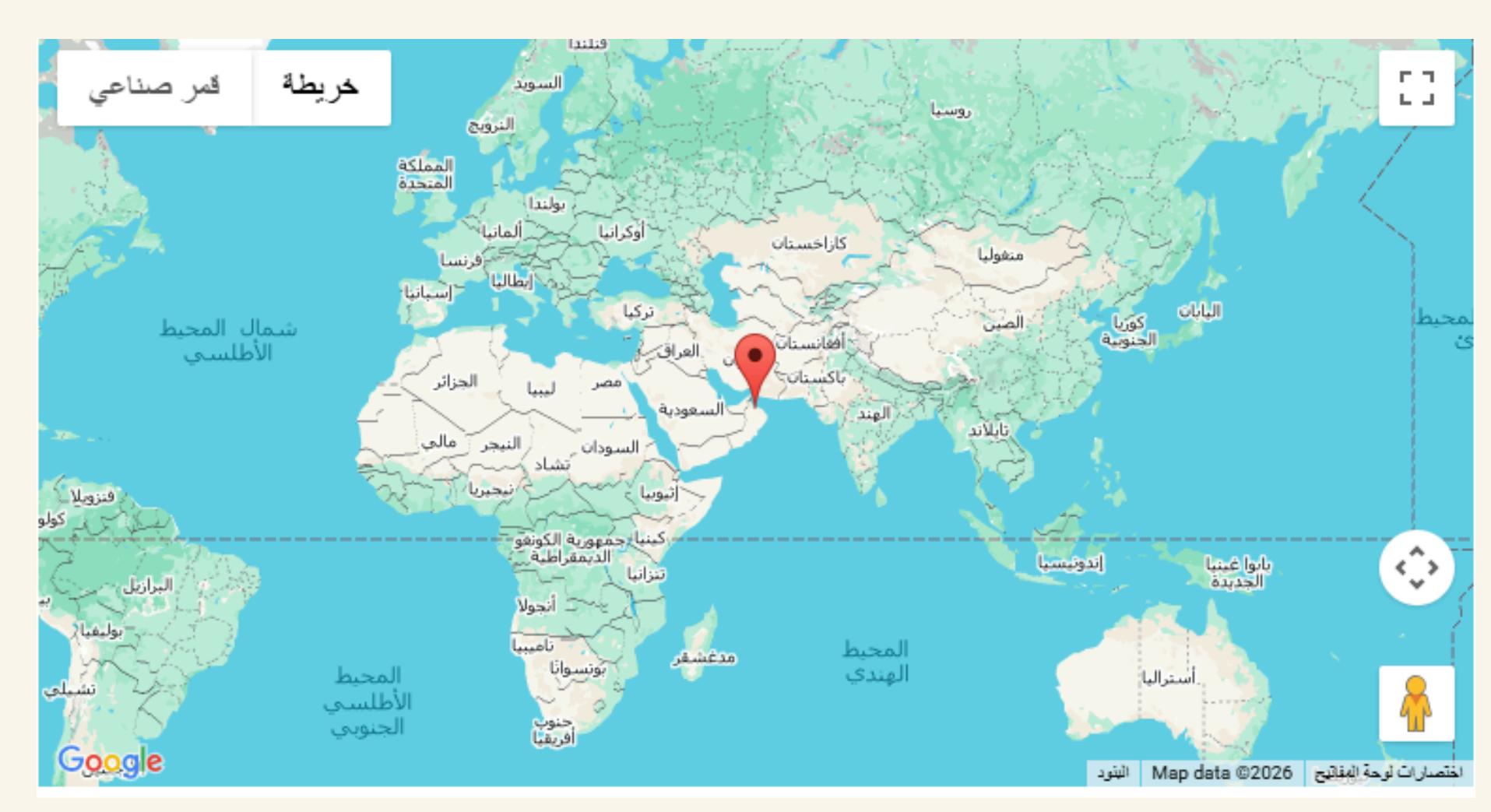


Dried coffee waste and eggshells were crushed and mixed to form a fine powder. The powder was added to greywater collected from a washing machine. Water temperature, pH, and electrical conductivity measured before and after treatment.

## Two tomato plants were used:

Plant A irrigated treated greywater  
plant B irrigated with untreated greywater

plant growth, leaf, color  
leaf thickness, and soil water absorption were observed.



## Results



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water property	Laundry Water only [Before]	Laundry water with powder [After]	Scientific note explanation
Temperature	23.5	21.5	Better water stability
pH	7.99	7.57	Closer to optimal range for plant
Electrical conductivity [EC,mS/cm]	2.2	1.3	Increases soil water retention and reduces drainage

These results show that adding the coffee waste and eggshell powder improves water quality, reduces salinity stress, stabilizes temperature, enhances soil water retention, and supports healthier tomato plant growth, demonstrating multiple environmental and agricultural benefits of the powder.

parameter	Laundry water only	Laundry water With powder
Leaf color	Pale green	Dark green
Stem strength	Weak	Strong
Leaf thickness	Thin	Thick
Soil water retention	Low	High



## Discussion



The results show that adding coffee waste and eggshell powder improved greywater quality and plant growth. The slight reduction in temperature indicates better thermal stability. The decrease in pH suggests a balancing effect due to calcium carbonate in eggshells. Lower electrical conductivity indicates reduced salinity, which helps plants absorb water more efficiently. Reduced conductivity also improves soil water retention and decreases water leakage. These findings are consistent with previous studies that reported improved soil structure and reduced salinity using organic waste materials. The treated tomato plant showed healthier growth, confirming that the powder reduced stress caused by greywater. This supports the effectiveness of the water-soil-vegetation protocol used in this study.

## Conclusions



This study concludes that coffee waste and eggshell powder can be used as an effective natural treatment for greywater. The powder improved water quality by stabilizing pH, reducing temperature, and lowering electrical conductivity. These changes enhanced soil water retention and supported healthier tomato plant growth. The method is simple, low-cost, and environmentally friendly. The experiment can be repeated with different plants or water sources, and additional protocols can be added to improve accuracy. Strengths of this study include the use of real household waste and clear comparison groups, while limitations include short observation time. Overall, this project shows strong potential for sustainable water reuse and waste recycling.

## References

