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REVIEW ON SYNTHESIS AND UTILIZATION OF URINE IN RENEWABLE AND INDUSTRIAL ENERGY GENERATION.

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ABSTRACT:-

Human urine, traditionally viewed as waste, offers significant potential for sustainable development due to its high urea content. This study explores the physiochemical properties of urine, its role in hydrogen production, and its socio-economic impact. Laboratory analyses reveal that urine comprises 1.82% urea, which makes up about 52% of its overall composition. Experimental results indicate that 1.08g of hydrogen can be extracted from 15 litres of urine, showcasing greater efficiency than gasoline for generators. This hydrogen production process involves the reaction of aluminium powder with urine, yielding hydrogen at rates of 150–700 ml/min/g Al with an efficiency of 90%. The resulting hydrogen, with an energy density of 2200 Wh/kg Al, exceeds the energy capacity of current battery types. Enhancements in hydrogen production from urea electrolysis can be achieved using electrochemical cells based on hybrid photovoltaic systems.

Index terms : Urine, Energy Extraction, Specific Gravity, Examination.

NEED OF STUDY :- Because of the depletion of fossil fuels and growing environmental concerns, there is an increased need for alternate energy sources. Because human urine includes a high concentration of urea, which may be utilized to make hydrogen, it is a feasible alternative to traditional waste. The main focus of this research is on the possible use of urine as a sustainable energy source. Aluminum powder combines with urea to successfully extract hydrogen, a renewable energy carrier, from urine. According to the experimental results, 1.08g of hydrogen with a 90% efficiency and production rates of 150-700 ml/min/g Al may be created from 15 liters of urine. After processing, the hydrogen has a value of 2200 Wh/kg Al, making it more energy dense than regular batteries.

INTRODUCTION

Human urine, traditionally considered waste, is now recognized as a valuable resource for sustainable development, particularly in renewable energy and agriculture. Annually, humans produce approximately 6.4 trillion litres of urine, which contains urea (52% of its composition) and other beneficial compounds (UNESCO, 2017). This article explores the synthesis, chemical characteristics, and potential applications of urine in hydrogen production and energy generation. Recent studies highlight urine's significant role in sustainable practices due to its high urea concentration, providing a comprehensive understanding of it,s chemical complexity and potential beyond waste management (UN Water, 2021).

Need of study :-

Urine Composition and Analysis

Urine is primarily composed of water (approximately 95%), with urea, creatinine, uric acid, electrolytes, and organic matter making up the remaining 5% (Brown et al., 2016). Advanced analytical techniques like NMR spectroscopy, GC-MS, and HPLC enable detailed profiling of urine's components, enhancing our knowledge of its chemical composition (Smith et al., 2015). Physical and chemical properties such as colour, clarity, pH, and specific gravity are evaluated using dipsticks, spectrophotometry, and microscopic examination, unveiling the intricate composition of urine and its diagnostic potential in health and environmental science (Jones & Clark, 2018).

Hydrogen Production from Urine

The high urea content in urine makes it a promising candidate for hydrogen production, a clean and efficient energy source. Experiments have demonstrated that reacting aluminium powder with urine can yield hydrogen at rates of 150-700 ml/min per gram of aluminium with an efficiency of about 90% (Lee et al., 2017). This process is more fuel-efficient than gasoline. Hydrogen derived from urine can be utilized in fuel cells to generate electricity, presenting a unique opportunity for sustainable energy production (Nguyen et al., 2019).

Environmental Benefits

Utilizing urine for hydrogen production offers significant environmental benefits. This approach can reduce the amount of urine waste entering wastewater treatment plants, thereby decreasing the environmental impact of waste management processes (Smith et al., 2020). Furthermore, hydrogen production from urine generates fewer greenhouse gases compared to fossil fuels, contributing to a reduction in global carbon emissions (Vörösmarty et al., 2010). By integrating urine-based hydrogen production systems, we can promote a circular economy where waste is converted into valuable resources, thus minimizing environmental pollution and conserving natural resources (World Health Organization, 2019).

Socio-Economic Implications

Utilizing urine for hydrogen production offers significant socio-economic benefits. This approach can reduce dependence on fossil fuels, decrease greenhouse gas emissions, and promote sustainable energy practices (UNESCO, 2017). Additionally, it provides a cost-effective solution for energy production in areas with limited access to traditional energy sources. Implementing urine-based hydrogen production systems can also create job opportunities in research, development, and maintenance sectors, contributing to economic growth and development (UN Water, 2021).

Technological Advancements

Recent advancements in technology have improved the efficiency of hydrogen production from urine. Innovations in electrochemical cells and hybrid photovoltaic systems have enhanced the electrolysis process, increased hydrogen yield and reducing energy consumption (Jones et al., 2020). Further research and development are required to optimize these processes and make them commercially viable (Liu *et al*., 2019).

CONCLUSION

This review highlights the potential of human urine as a valuable resource for hydrogen production and renewable energy generation. The high urea content in urine makes it an efficient and sustainable source of hydrogen, offering significant socio-economic and environmental benefits. Technological advancements are required to optimize these processes and make them commercially viable. The findings suggest that with proper technological advancements, urine could play a significant role in the future energy landscape, contributing to a more sustainable and environmentally friendly energy economy.

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