RESEARCHING OF SORPTION CYANIDATION OF ALL SAMPLES AFTER ACOUSTIC SONIC TREATMENT

Azimov O.A.
Candidate of technical sciences, Associate professor,
Navoi State University of Mining and Technologies
Kurbonova Sh.R.
Postgraduate student, Navoi branch Academy of Science

Abstract: The process of sorption cyanidation plays a vital role in the extraction of precious metals such as gold from ores. By combining the principles of sorption, where molecules are adsorbed onto a surface, and cyanidation, a method of extracting gold from ore using cyanide solution, this technique has been widely used in the mining industry. However, recent advancements in technology have introduced the integration of acoustic sonic treatment into this process, opening up new avenues for research and innovation in the field of ore extraction and processing. Acoustic sonic treatment involves the application of high-frequency sound waves to a solution or material. In the context of ore processing, this treatment has shown promise in enhancing the efficiency of various processes, including leaching and extraction. By subjecting samples to acoustic sonic waves prior to sorption cyanidation, researchers aim to improve the overall recovery rates of precious metals and optimize the extraction process.

Key words: Mining industry, chemical properties, better quality, reduced chemical usage, energy efficiency.

Introduction: The research on sorption cyanidation of samples after acoustic sonic treatment focuses on several key aspects. Firstly, it investigates the changes in the physical and chemical properties of the samples induced by the acoustic waves. These changes can impact the surface area available for sorption and the reactivity of the samples during cyanidation. Understanding these alterations is crucial for optimizing the overall efficiency of the extraction process. As with any other physical agent, ultrasound has the potential to produce adverse effects at sufficiently high doses. In addition, biological effects of unknown significance have been reported at low exposure levels under laboratory conditions.

The advantages of ultrasound extraction include selectivity, better quality, reduced chemical usage, and energy efficiency. The disadvantages are that ultrasound alone may not be sufficient to inactivate all microorganisms and that the effects depend on the type and shape of the microorganisms. A novel technique like ultrasound is a promising technique for the reduction of antinutritional factors effectively by keeping the natural phytoconstituents in it. The reduction of antinutritional factors by ultrasonication resulted from the high temperatures and pressures generated amid the collapse phase of cavitation bubbles. Microwave heating depends on the dielectric properties of the food [1]. The dielectric constant is the ability to absorb the energy, and dielectric loss is the ability to reflect where it is dissipated as heat. Because of its heat-labile nature and the formation of insoluble complexes, microwave treatment reduces the antinutrient component. This review focused on several studies on yam oxalate concentrations that were conducted using various treatments. This would help researchers and the food industry find more effective strategies to reduce the antinutritional factor using frequency-controlled power ultrasound.

Figure 1. Conventional methods and Novel technology for oxalate reduction.

One notable challenge is dealing with objects that have a soft or uneven surface. These surfaces may absorb ultrasonic sound waves rather than reflect them, leading to inaccurate readings. Also, the angle of the object plays a critical role; a parallel surface to the sensor is ideal for accurate detection. Ultrasound-assisted extraction can be used as an alternative to traditional sample preparation methods for elemental analysis and speciation where matrix separation rather than complete matrix elimination is performed [2]. With an ultrasonic sensor, an accuracy of up to 1% of the set measuring range can be achieved. This means that an object can be detected with an accuracy of 1 mm at a distance of 10 cm. In order for an ultrasonic sensor to work reliably, the sound is emitted at a fixed frequency. When low pressure is applied to the liquid, high-intensity ultrasonic waves are produced, creating small vacuum bubbles in the liquid.
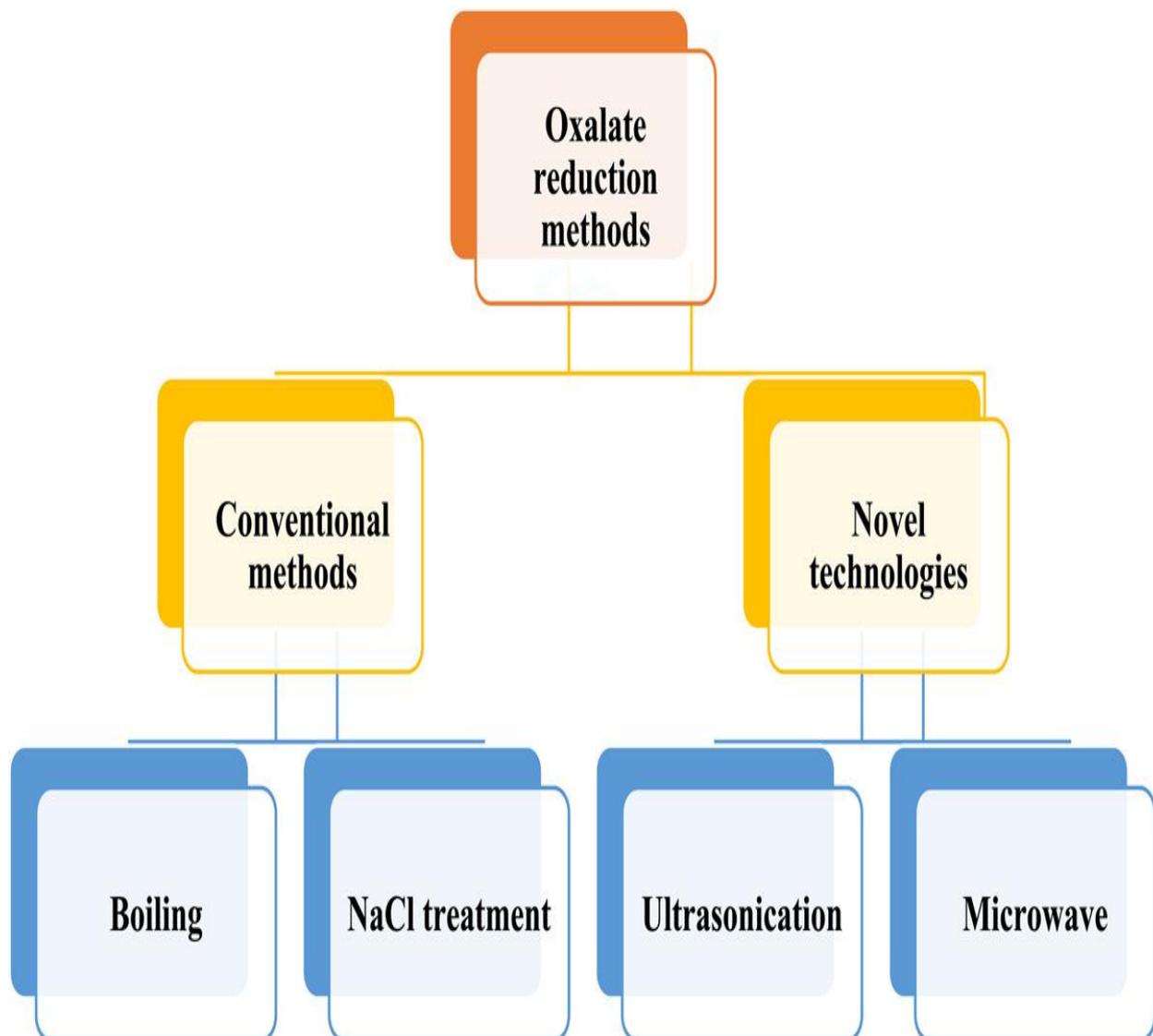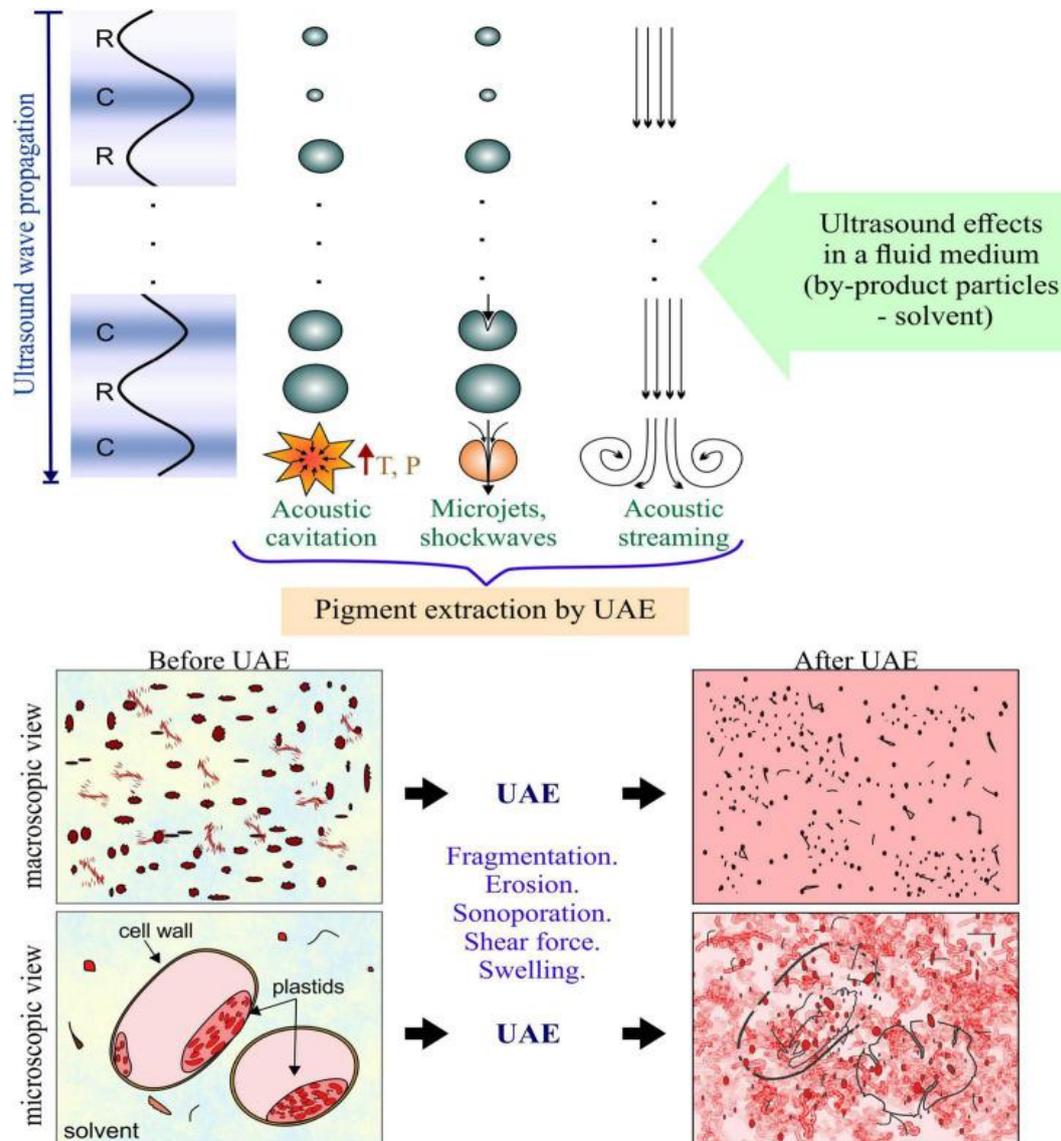
Figure 2. Ultrasound effects that promote mechanisms of pigment extraction through processing.

As the bubbles reach their saturation level, they collapse and this happens in the high-pressure cycle. This process is termed cavitation. Sounds with a frequency of 20 kHz and higher are referred to as ultrasound (or ultrasonic sound). High frequency sound is sound of which the frequency lies between 8 and 20 kHz. High frequency sound with a frequency over 16 kHz can hardly be heard, but it is not completely inaudible. Ultrasonic sound waves are inaudible to humans, but they can be recorded by microphones. You can use an ultrasonic recorder or a bat detector to record ultrasonic sound [3]. These devices can transform ultrasound signals into sounds that can be heard by humans. Sonication is the act of applying sound energy to agitate particles in a sample, for various purposes such as the extraction of multiple compounds from plants, microalgae and seaweeds. Ultrasonic frequencies (> 20 kHz) are usually used, leading to the process also being known as ultrasonication or ultra-sonication. Overall, adsorption is a surface process that leads to transfer of a molecule from a solution bulk to a solid surface whereas sorption is a less constrained process that can be either

adsorption or absorption. Ultrasound is an emerging technology, which has been highly explored in the food area to improve processes and products. When ultrasound is applied to a product with solid or fluid characteristics, the passage of acoustic waves and acoustic cavitation generates different mechanisms responsible for modifications in the original matrix of the sample. These effects of ultrasound can also be used to take advantage of by-products, for example by extracting compounds of interest, including natural pigments. Natural pigments or colorants are being highly demanded by different industries not only for color purposes but also due to their healthy properties, the greater demands in regulations and new consumer preferences. This review presents an updated critical analysis of the application of ultrasound-assisted extraction to obtain natural pigments from food processing by-products. Initially, the ultrasound effects and mechanisms that improve the extraction of natural pigments in a fluid medium, as well as the factors that influence the extraction and the energy consumption of analyzed and described [4]. Different conventional and emerging technologies or methods have been applied to extract bio compounds from by-products. Among them, the conventional methods include those that have been used for a long-time such as distillation, solvent extraction, maceration, heat treatment and extraction. However, these methods present disadvantages, they are time, energy and solvent consuming, present low extraction yields and induce the loss of thermolabile compounds. Ultrasound System for pigments from by-products, two types of ultrasound devices were used: an ultrasonic bath or an ultrasonic probe. The ultrasonic bath consists of a bath with one or many ultrasonic transducers attached at the bottom. The ultrasonic probe is the most powerful source of ultrasound, working at lower frequencies than ultrasound baths and consists of an ultrasonic transducer attached to a sonic horn composed of a titanium alloy. This material is thermo-resistant and behaves well under corrosive conditions; however, the erosion of this material is often important since it could represent a health risk. In both systems, the by-product sample with their respective solvent can be placed in direct contact with the ultrasound device and in the case of an ultrasonic bath, the by-product and solvent can be placed in a container immersed in a medium to transmit ultrasound waves. The time effect is similar to an increase in acoustic power, amplitude and temperature, after reaching a maximum point, further increases in each of these parameters will cause the yield reduction. In this sense, a very short extraction time can be insufficient to complete the extraction leaving target compounds in the sample. Initially, the increase in sonication time increases the yield reaching a maximum, at this time, the cavitation effect enhanced the extraction mechanisms. That is, when reaching a maximum yield at a certain time, the equilibrium concentration of the extracted pigment is reached. However, further increment in time, could result in oxidative degradation of the extracted compounds decreasing the yield [5].

To overcome these disadvantages of conventional methods, the emerging, also called non-thermal or non-conventional, technologies are being explored. Different emerging technologies, including supercritical fluid extraction, microwave-assisted extraction, ultrasound-assisted extraction, high-pressure homogenization, pulsed electric fields, high voltage electrical discharges, light stresses, enzyme- assisted treatment, among others, have been proposed, developed, and improved.

Conclusion: Overall, the integration of acoustic sonic treatment into the sorption cyanidation process represents a promising avenue for improving the efficiency and effectiveness of ore extraction. Through comprehensive research and experimentation, scientists are uncovering the potential benefits of this innovative approach and paving the way for advancements in the field of mineral processing. Moreover, the study delves into the kinetics of sorption cyanidation post-acoustic treatment. By analyzing the rate at which the sorption of cyanide and the subsequent gold extraction take place, researchers can fine-tune the parameters involved in the process to maximize yields. This

kinetic analysis provides valuable insights into the mechanism of metal extraction and enables researchers to devise strategies for enhancing recovery rates.

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