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Abbreviations: NaCl: Sodium Chloride; Ppm: Parts Per Million; RIP: Ribosome Inactivating Protein

Mini Review

Various Media used to Detoxify *Abrus precatorius* – A Mini Review

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Abstract

Abrus precatorius, sometimes referred to as jequirity bean or rosary pea, is a tropical and subtropical plant species that is extensively scattered all over. It is highly dangerous because of the presence of abrin, an exceptionally toxic protein. *A. precatorius* is a poisonous plant with great traditional and pharmaceutical value; therefore, to safely utilize its potential benefits, detoxification techniques are required. This review methodically examines the numerous detoxification strategies used in various media to lessen *A. precatorius*'s toxicity. There are various methods employed to detoxify the seeds which include cow's milk, cow's urine, fermented rice water, lemon juice, etc. The possible applications of detoxified *A. precatorius* in conventional medicine, pharmaceuticals, and agro-industrial sectors are also reviewed in this paper. Additionally, the paper also emphasizes new developments and potential paths for detoxification research, highlighting the necessity of creative solutions to maximize detoxification effectiveness while protecting bioactive components

Introduction

Abrus precatorius L., belonging to the family of Fabaceae is native to India and is now commonly found throughout the tropical and subtropical parts of the world [1]. *A. precatorius* is a slender, perennial climber that twines around trees, shrubs, and hedges and is used as a medicament in traditional system of Indian medicine as antimicrobial, anti-helminthic, antioxidant, anti-diarrhoeal, antiemetic, inhibits intestinal motility, anti-malarial, anti-fungal, nephroprotective, immunomodulatory, neuro-muscular, anti-diabetic, prophylactic, and memory enhancing properties [2]. When seeds are cracked, chewed, or have their outer shell removed, they become poisonous [3]. Children gather the incredibly gorgeous seeds for beads. Occasionally, they are fashioned into rosaries and necklaces. Therefore, it is believed that a detoxification procedure is required to eliminate the toxicity of seeds.

One of the deadliest plant toxins known to man, abrin, is found in the seeds of the *A. precatorius* plant [4]. The seeds are displayed in Figure 1. Abrin can have a disastrous effect on the human body, even in very small doses, leading to serious sickness and occasionally even death. It is just as toxic as another notorious plant poison, ricin.

Figure 1: Seeds of *Abrus precatorius*.

By preventing the synthesis of proteins, abrin causes cellular damage as well as systemic failure. Chewed seeds can result in gastrointestinal toxicity, including throwing up, bloody diarrhea, and multisystem organ failure, while intact seeds may not be hazardous when consumed [5].

In many traditional practices, *A. precatorius* is used despite its toxicity, especially in areas where it grows prolifically. Its potential for devastation cannot be exaggerated, though. Significant consequences may arise from accidental consumption or even skin contact with the seeds. As such, extreme caution should be used when

working with any portion of this plant. Shodhana or purification of these seeds, which denotes its cleansing by various methods, is described in Ayurvedic pharmacopeia [6].

Shodhana

The *Ayurvedic* texts recommend the *shodhana* process of *Abrus* seeds. Any shodhana procedure's primary goal is to lessen the toxic components to some extent or to accelerate their chemical transformation into non-toxic or comparatively less toxic compounds [7,8]. Sagar and his team employed *swedana* as the *shodhana* process for the detoxification of the *A. precatorius* seeds. When *Abrus* seeds are subjected to *shodhana*, the toxin protein is expected to be deactivated by the mechanism of denaturation [9].

Some of the ways to remove toxicity in Abrus are detailed as follows:

One straightforward approach is to physically remove the outer coating of the seeds, where much of the toxin is concentrated. This can be done by carefully scraping or sanding the surface of the seeds. However, this method is not entirely reliable, as abrin can penetrate beyond the outer layer of the seed. To remove toxicity from *A. precatorius* seeds, treatments like damaging the seed coat (nicking) and soaking in gibberlic acid (100 ppm) for 24 hours are effective methods [10].

Leaching involves soaking the seeds in water or other solvents to extract the toxins. This method is commonly used in traditional practices but has limited efficacy against abrin due to its water-insoluble nature. Earlier studies have reported the purification of Gunja seeds with lemon juice, kanji (with fermented rice), cow's milk, cow's urine, NaCl, and ghee [11]. Additionally, leaching may not remove all traces of the toxin, posing a risk of residual toxicity [9,12].

Heating the gunjas in cow's milk is the detoxification method, which is supposed to eliminate the poison. Toxic substances such as lectin, abrin, a fat-splitting enzyme, a glucoside abrussic acid, urease, alkaloids, and steroidal oil with abortive effects have been linked to Abrus seeds [13-16]. Lactose, fatty acids, casein, milk proteins, lipoprotein lipase, xanthin oxidase, acid phosphatase, lacto peroxidase, calcium phosphate, and citrate salts are among the substances included in cow's milk. When Abrus seeds are boiled with any media, one of the following mechanisms may eliminate the poisons indicated above 1). The poisonous protein abrin is a type II ribosome-inactivating protein (RIP) which is also present in ricin is composed of a single polypeptide A chain and B chain that is a lectin connected by a disulfide bond [17]. A chain needs a B chain to function and is not harmful to healthy cells. The components of the media may break the disulfide bond, rendering the proteins inactive. 2) The proteins may also get denatured due to the heat used during the treatment [5]. While using milk as the media, the alkaloids present in the seeds might form a strong complex with one of the components of the milk and hence get denatured [6]. The steroidal oil present in the seed would have dissolved in the fatty acid content of the milk to form an emulsion.

Few researchers have reported the process of soaking *Abrus* seeds in cow urine for seven days [18] and roasting them in cow ghee till it gets swollen to make them *shodhit* (detoxified) [19]. Cow urine and regular saline water were chosen by the researchers as the detoxifying media because they both contain high ions, which are necessary to dissolve the disulfide bond [20]. As mentioned earlier, gunja seeds have long been detoxified with the help of kanji and cow's milk. Given that kanji (sour gruel) and milk, both include a variety of ions, including water, lipids and fats, proteins, lactose sugar, inorganic phosphates, calcium, magnesium, sodium, and potassium [21]. Whereas a large concentration of ions is found in a cow's urine such as water, sodium, nitrogen, and Sulphur. It also contains both fat-soluble and water-soluble vitamins such as A, B, C, D, and E, some minerals such as iron, magnesium, calcium, and phosphate salts, along with lactose sugar, citrates, enzymes, and hormones. The higher concentration of ions present in the cow's urine is helpful to break the disulfide bond between both the chains of abrin. Therefore, few researchers have come forward to use Nacl (normal saline water) and cow Urine as media to purify the seeds before developing medicinal drugs from them or use regular saline water and cow urine as a medium [19].

Exposing the seeds to high temperatures is another proposed method for reducing toxicity. Heat can denature proteins, including the toxin abrin. However, abrin is known to be quite heat-stable, requiring prolonged exposure at high temperatures to be effectively neutralized. Moreover, excessive heat can damage the seeds and compromise their viability. Hence the seeds are suspended in any media and heated for a prolonged time to denature the protein.

In recent years, advances in biotechnology have raised the possibility of genetically engineering *A. precatorius* plants to produce non-toxic seeds. By altering the genetic makeup of the plant, scientists aim to suppress the production of abrin or modify its structure to render it harmless. However, this approach is still in the experimental stage and poses ethical and ecological concerns [22]. Vinita and his team isolated a chimeric protein, comprising 1-123 amino acids taken from the A chain of abrin and 124-175 amino acids from the *A. precatorius* agglutinin A chain, as a vaccine candidate against abrin intoxication [23].

Conclusion

In summary, while *A. precatorius* may captivate with its beauty, but its seeds harbor a deadly secret. Its bright appearance deceives people from the danger that its toxic ingredients represent. Hence it is necessary to detoxify its seeds with the help of various media. Exercise caution and respect when encountering this plant, and ensure proper education on its potential hazards to prevent accidental exposure. In conclusion, while various methods for reducing the toxicity of *A. precatorius* seeds have been proposed, none are without challenges or limitations. Each approach presents its own set of complexities, requiring careful consideration of factors such as efficacy, feasibility, and potential side effects. Further research and innovation are needed to develop practical strategies for detoxifying these seeds and mitigating the risks they pose to human health. In the meantime, emphasis should be placed on prevention through education and prudent handling practices.

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