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LETTER TO THE EDITOR

Corrosive Burns From Cashew Nut Shell Liquid (CNSL): Emphasizing the Need for Caution in Transport and Handling

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Cashew nut shell liquid (CNSL) with CAS registry number 8007-24-7, is a versatile by-product of the cashew industry. The nut has a shell of about 1/8-inch thickness inside which is a soft honey comb structure containing a dark reddish brown viscous liquid. This liquid is a significant byproduct of cashew nut and cashew apple production, derived from the cashew tree (Anacardium occidentale). CNSL, the pericarp fluid of the cashew nut, consists of a mixture of phenolic compounds with aliphatic side chains. Natural CNSL comprises roughly 70% anacardic acid, 5% cardanol, and 18% cardol [1]. Many countries import raw cashew nuts for processing, producing CNSL as a byproduct. India, Brazil, Bangladesh, Tanzania, Kenya, Mozambique, tropical Africa, Southeast Asia, and the Far East produce significant quantities of cashew nuts and CNSL.

CNSL provides cost-effective and sustainable alternatives by replacing phenol in manufacturing processes, thus mitigating the environmental impact associated with chemical usage. Its applications range from friction linings to bio-fuel, promoting the sustainable utilization of cashew nut byproducts. CNSL has diverse industrial applications, including resin production for coatings, adhesives, and friction materials. It is also used in insecticides, automotive brake linings, laminating varnishes, rubber compounding, and surface coatings such as paints and varnishes.

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CNSL constituents can be absorbed via ingestion, inhalation, and skin contact. CNSL constituents are metabolized by the liver into hydrophilic substances and excreted through urine or bile. Additionally, they can accumulate in adipose tissue [2]. CNSL toxicity is commonly observed in farmers engaged in cashew processing. Workers slicing outer cashew nut shells often come into contact with the oil, leading to brownish to thick black sheets of dead skin on their hands. Other skin issues seen in these communities include maceration, loss of dermatoglyphics, pitted keratolysis, and fingertip pits. This occupational hazard can be prevented by oiling the hands/ wearing proper gloves and other personal protective equipment [3].

Transporting CNSL is risky due to its corrosive phenolic derivatives, which can pose serious health and safety hazards if released in an accident. Strict safety measures and protocols are essential to mitigate these risks. We report a case concerning a 43-year-old male who suffered extensive corrosive burns due to the spillage of high concentration CNSL and subsequently succumbed to injuries sustained in a road traffic accident. Upon autopsy, partially healed dermo-epidermal chemical burns affecting 67-70% (Figures 1 and 2) of the total body surface area, were observed across the body. Additionally, closed fractures of both bones in the left leg (stabilised with intramedullary nails and external fixator) were noted at the proximal part, with all underlying tissues exhibiting signs of gangrene. Internally, both pleural cavities contained about half a litre of yellow fluid. Both lungs emanated foul-smelling greenish purulent material on cut section.

The histopathological examination, of kidney showed acute tubular necrosis, the lung displayed dilated alveoli with acute and chronic inflammatory cells, congested and dilated blood vessels, the skin exhibited denuded and ulcerated epidermis with acute to chronic inflammatory cell collections and areas of coagulative necrosis, along with congested blood vessels in the dermis. (Figure 3). The total timeline between exposure to CNSL and death in this case was approximately two weeks. The review of clinical records revealed that, despite aggressive orthopaedic and chemical burns management, the patient developed compartment syndrome in the fractured leg. A fasciotomy was performed, and burns care was initiated. However, the patient subsequently developed acute renal failure, possibly due to crush syndrome exacerbated by extensive chemical burns. The large surface area of burns made the patient prone to sepsis, leading to multi-organ dysfunction syndrome. Clinical chemistry parameters were consistent with acute renal failure and sepsis. The cause of death was determined to be *"Septicaemia consequent to chemical burns associated with fracture of both bones of the left leg."*

Figure 1. Dermo-epidermal chemical burns due to CNSL

Figure 2. Dermo-epidermal chemical burns due to CNSL

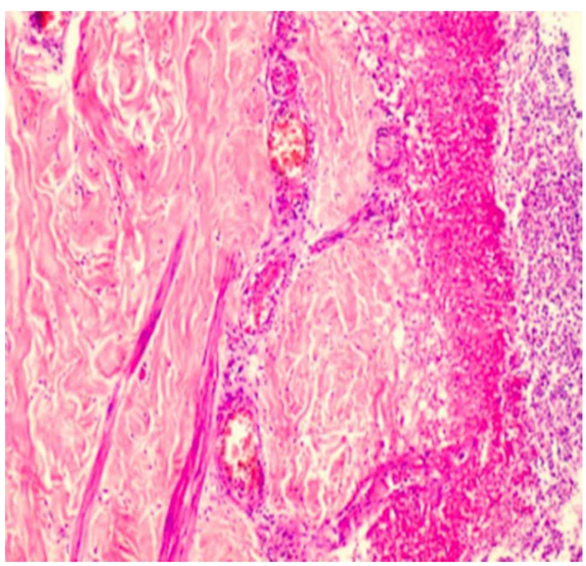

Figure 3. Skin HPE: Inflammatory infiltrates and coagulative necrosis due to corrosive effects of CNSL (H & E 40X)

Acute CNSL poisoning, depending on the concentration of the substance, can present with various symptoms due to its corrosive effects on the gastrointestinal tract, including burning sensation, difficulty in swallowing, intense thirst, and tenesmus etc. If aspirated, it can cause chemical pneumonitis. CNSL contains several alkylated phenols, with anacardic acid being the primary component. This compound, similar to urushiol in poison ivy, can cause contact dermatitis and may eventually result in hyperpigmentation of the affected areas. Additionally, CNSL exposure can lead to toxic hepatitis, affecting coagulation, indicated by elevated prothrombin and partial thromboplastin times, suggesting a potential inhibitory effect on clotting factors. The principles of management include prompt decontamination with activated charcoal, followed by symptomatic treatment. In cases of toxic hepatitis and metabolic acidosis, fresh frozen plasma, bicarbonate, proton pump inhibitors, steroids, and N-acetylcysteine should be used [4].

Research conducted on mice regarding the toxicity of CNSL, particularly its main constituent anacardic acids (AAs), demonstrates varying levels of toxicity depending on the dosage and duration of exposure. The hepatorenal and hematopoietic systems appear to be primarily affected, while genotoxicity is not observed [5].

Interestingly, in vivo research has shown that CNSL derivatives offer a sustainable option for selective peroxisome proliferator-activated receptor (PPAR) modulators, with moderate affinities (EC50 around 100 nM to 10 μM), promoting beneficial gene activation patterns for treating diabetes and obesity [6]. Moreover, CNSL derivatives have also been considered as potential drug candidates to treat Alzheimer's disease [7].

This case underscores the significant risks associated with CNSL, an acidic corrosive substance. Similar to regulations in other countries governing the transport of hazardous substances, we need to establish regulations for CNSL transport in India. While fatalities related to CNSL exposure are rare, cases of self-limiting toxic hepatitis have been reported. The hepatotoxicity can impact the coagulation system, potentially leading to death. In the present case, the severity of chemical burns exacerbated the situation, making the fracture management more challenging. Therefore, raising awareness about safety measures when handling and transporting CNSL is crucial.

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Statements and Declarations

Conflicts of interest

The authors declares that they do not have conflict of interest.

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Ethical Considerations

All ethical concerns should be addressed by the authors

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