

Formulation and Evaluation of Custard Apple Seed Oil

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ABSTRACT

The seeds of *Annona squamosa*, commonly known as custard apple, have garnered attention in recent years due to their potential nutritional, medicinal, and phytochemical properties. Despite the fruit's widespread consumption, the seeds, which are often discarded, contain a variety of bioactive compounds such as alkaloids, flavonoids, tannins, and essential fatty acids. Research has suggested that custard apple seeds exhibit anti-inflammatory, antimicrobial, antioxidant, and anticancer activities, making them a promising candidate for various therapeutic applications. Additionally, their rich nutritional content, including proteins, lipids, and carbohydrates, positions them as a potential alternative food source in regions suffering from food insecurity. However, the seeds also contain certain toxic compounds, such as annonacin, which pose health risks if consumed in excess. This review provides a comprehensive analysis of the chemical composition, health benefits, toxicological risks, and potential uses of custard apple seeds, offering insight into the need for further research to harness their full potential while mitigating associated risks. The review concludes with a discussion on future research directions and the importance of developing safe and sustainable methods for utilizing custard apple seeds in food and medicine.

Keywords: *Annona squamosa*, custard apple seeds, bioactive compounds, health benefits, toxicity, nutritional properties, medicinal applications

INTRODUCTION

Custard apple (*Annona squamosa*) is a tropical fruit native to the Americas, but it is widely cultivated in tropical and subtropical regions across Asia, Africa, and the Pacific Islands. The fruit is known for its sweet, creamy pulp, which is highly nutritious, containing vitamins (such as vitamin C), minerals, and carbohydrates¹. While the pulp is enjoyed worldwide, the seeds of the custard apple, which constitute approximately 10–20% of the fruit's total weight, are generally discarded, despite their potential value. Recent studies have highlighted the rich chemical composition of custard apple seeds, which contain bioactive compounds with promising pharmacological properties. These seeds are rich in

alkaloids, tannins, flavonoids, essential fatty acids, and other phytochemicals that have demonstrated antioxidant, antimicrobial, anti-inflammatory, and anticancer activities in vitro². Historically, parts of the custard apple plant, including the seeds, have been used in traditional medicine to treat a variety of ailments such as gastrointestinal disorders, parasitic infections, and inflammation³. Recent scientific evidence supports many of these traditional uses, though there are concerns regarding the potential toxicity of certain compounds, particularly annonacin, a neurotoxin found in the seeds. Therefore, understanding both the therapeutic potential and the safety profile of custard apple seeds is critical for their effective utilization in food and medicine⁴.

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Fig 1: Custard Apple Seed

Despite growing interest, research on custard apple seeds remains limited, with much of the existing literature focusing on the fruit's pulp and the broader genus *Annona*⁵. This review aims to provide a comprehensive overview of the chemical

composition, health benefits, toxicological aspects, and potential applications of custard apple seeds. By synthesizing current research, this paper highlights the need for further studies to explore the full potential of custard apple seeds while addressing safety concerns⁶.

Parts of plant	Morphological characters
Leaves	Deciduous, rectangular, slender-lanceolate
Fruit	Compound, heart shaped, abnormal, yellow or brown color when ripped
Seed	Dark brown or black in color, glossy, oblong and smooth
Flower	Flowers present drooping clusters, fragrant, slender, greenish yellow in color

Synonyms:

English: custard apple, sugar apple, sweet sop

Sanskrit: seetaphalam, sudha, subha

Hindi: seetaphal, sharifa, ata

Malayalam: athachakka, atha, seetapazham

Kanda: sitaphal

Telugu: sitaapandu

Tami: sitapplam

Bengali: ata

Arabic: ghista

Italian: pomo canella

French: pomme de cannelle, attire

Portuguese: atta, fructa do conde

Taxonomical Classification:

Kingdom	Plantae
Subkingdom	Tracheobionta
Super division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Sub class	Magnoliales
Order	Magnoliales
Family	Annonaceae
Genus	Annona L
Species	Annona squamosa

Chemical Constituents:

Fruits: Sugar (up to 28%), Vitamin C, Iron, Calcium, Thiamine, Amino acid, Potassium, Carotene, Riboflavin, Niacin, Ascorbic acid, Magnesium and dietary fibers⁹.

Leaves: Isoquinoline alkaloids, Acetogenine (annoreticulin and isoannoreticulin), Dopamine alkaloid, Salsolnol, Coclaurine, Carvone, Eugenol, Farnesol, Geraniol, Limonene, Linalool, Menthone, Atrophine, Roemerine, norisocoryline and sugars like rhamnoside and quercetin-3-glycoside. Leaf oil yielded 59 chemical compounds¹⁰.

Roots and Stem: Liriodenine, Oxoanalobine, Borneol, Camphene, Camphor, Car-3-ene, β -Caryphyllene, Eugenol, Farnesol, Geraniol, 16-Hetriacontanone, Hexacontanol, Higemamine, Isocorydine, Limonine¹¹.

Bark: Bullatacin, N-Nitrosoxylopine, Roemerolidine, Duguevalline, Mosinone-A, Mosin-B, Mosine-C, Squamone¹².

Seeds: Acetogenin, Solamin, triterpenoids (stigmaterol and sitosterol), Annotemoyin-1, Annotemoyin-2, Squamocin, cholesteryl, glucopyranoside¹³.

Advantages of Custard Apple Seeds:

1. Traditional Uses: The custard apple is used by indigenous as an insecticidal and antitumor agent, anti-diabetic, antioxidant, anti-lipidemic, and anti-inflammatory agent. It might help prevent wrinkles, acne and maintain a healthy glowing skin. It is also considered to be good for hair problems such as lice infections. The seed oil extract of custard apple may help with the growth of hair¹⁴. The seeds are reported to possess anti-parasitic activities (against lice). A cream consisting of 3 cl bee wax, 12 cl almond oil, 3 cl coconut oil, 6 cl of water, 6 cl glycerin, and 1 handful of crushed plant's seeds is prepared and heated over a water bath for 3 h before applying to the hair. Due to presence of magnesium in it, which is also helpful in removing the acid from the body joints¹⁵.

2. Anti-tumor Activity: Acetogenin Ascorbic acid Alkoloids Neutritional components of Sitafal Cyclopeptide Polysaccharide Carotenoids Fatty acid Protein International Journal of Research Publication and Reviews, Vol 4, no 3, pp 4177-4182 March 2023 4179 The plant custard apple having the potent bioactive principles in all components of parts. The effect of aqueous and organic extracts from the seeds of plant was studied on a rat histiocytic tumor cell line AK-5. Both the extracts of the plant caused significant apoptoictumor cell death with enhance caspase3 activity¹⁶. Down regulation of anti-

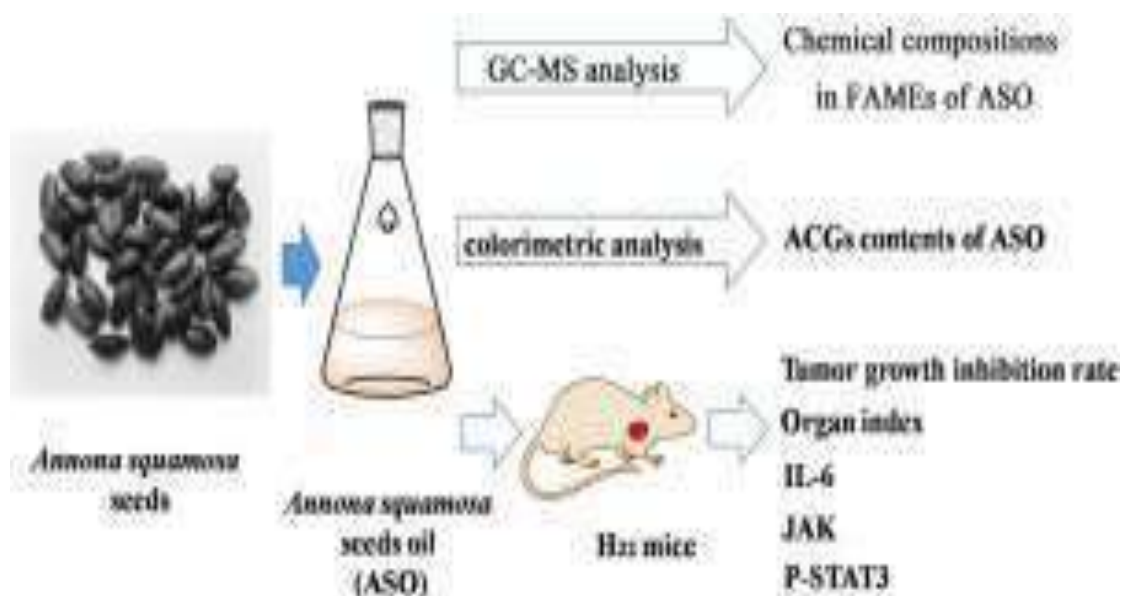


Fig 2: Anti-Tumor Activity

apoptotic genes Bcl-2 and Bclxi and enhance the generation of intracellular ROS, which correlated well with the decreased levels of intracellular GSH. Aqueous extract of plant's seeds possessed significant antitumor activity in-vivo against AD-5 tumor.

3. Antimicrobial activity: Antimicrobial activity that inhibit growth of bacteria, prevents the development of microbial colonies and also kill the microorganisms. The microorganisms become the resistance to many antibiotics which results in the difficulty in the treatment of the disease or cause more challenging for treatment. The seed extract of annona Squamosa have revealed antibacterial effects against the Staphylococcus aureus with the minimum Inhibitory Concentrations (MIC) of 50 mg/mL and also Minimum Bactericidal Concentrations (MBC) of 100 mg/mL. The seeds extract of A. Squamosa was tested against the various bacterial strains including E. coli, bacillus subtilis, stephylococcus aureus, klebsiella pneumonia, proteus microbilis and salmonella typhy to check the effectiveness. The chloroform seed extract showed that having remarkable Antimicrobial activity. In another studies the methanolic extract or the cotyledon extract of custard apple seeds was also found for its antimicrobial activity¹⁷.

4. Anti-head lice effect: The present study focused on the separation and identification of the active compounds against head lice from the hexane extract of Annona squamosa seed, the chromatographic and spectroscopic techniques revealed that two major compounds of the hexane seed extract were oleic acid and triglyceride with one component oleate ester. These compounds are diluted with coconut oil and were found to kill all tested head lice in 49, 11 and 30 min respectively¹⁸.

5. Antiplatelet activity: Increased platelet activity is the risk of cardiovascular events in healthy men as well as in patients with coronary artery disease. The antiplatelet activity on human platelets of custard apple peel and seed extracts was studied using turbidimetry according To the methodology described by Born et al. The Annona Squamosa seed extracts acts against the platelet activations by reducing P-selectin expression. Custard apple seed extract was able to decrease the activation of GP IIb/IIIA at the highest concentration studied¹⁹.

6. Antidiabetic activity: International Journal of Research Publication and Reviews, Vol 4, no 3, pp 4177-4182 March 2023 4180 Diabetes is the common endocrine disorders²⁰, it is characterized by altered carbohydrate, insulin and protein metabolism as a consequence of lack of pancreatic insulin or insulin

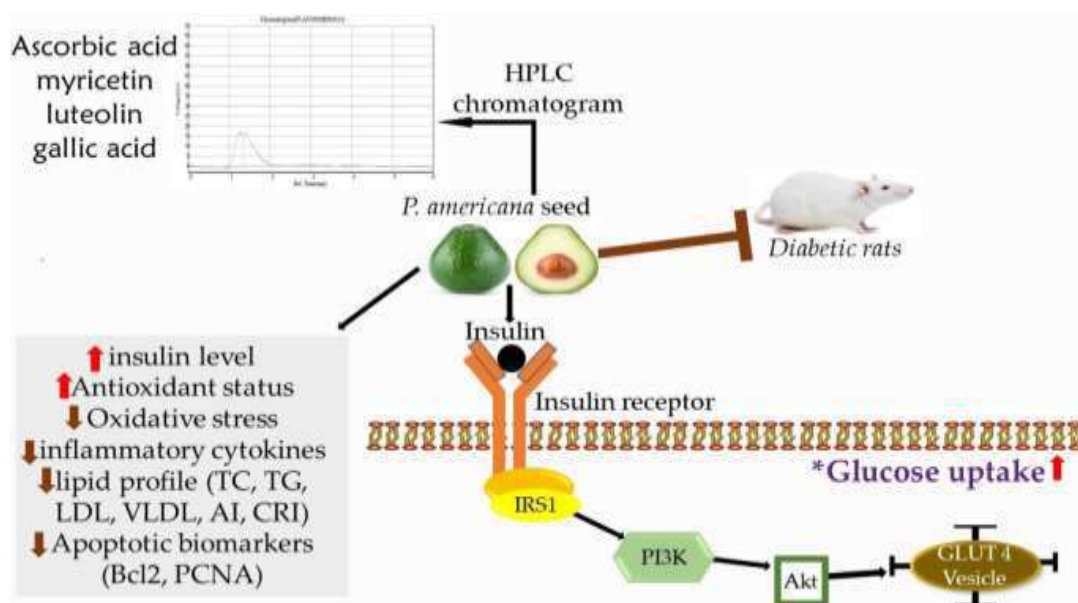


Fig 3: Anti-Diabetics activity

dysfunction. The World Health Organization (WHO) reported that, 80–90% of people above 40 years old

are more prone to non-insulin-dependent diabetes. In a study, the ethanolic and methanolic seed extract of custard apple was administered to alloxan-induced

diabetic rats (150 mg/kg body weight (BW)) to check its effect on blood glucose levels in diabetic rats. The ethanolic (dose: 200 mg/kg) and the methanolic (dose: 200 mg/kg) seed extract of custard apple exhibited significant dose dependent 43.96% and 45.99% antihyperglycemic activity respectively. This result shows that the ethanolic extract was less effective than the standard used (gliben clamide) for hyperglycemic activity²¹.

Disadvantages of Custard Apple Seeds:

1. Toxicity

Custard apple seeds contain a group of compounds called anonaine and other alkaloids, which can be toxic in large quantities. These compounds have been found to have neurotoxic effects, and consuming large amounts of seeds can lead to symptoms such as dizziness, nausea, and even seizures in extreme cases. It is important to avoid consuming the seeds raw or in large quantities.

2. Digestive Issues

Due to their hard, indigestible nature, the seeds can be difficult for the body to break down. If ingested accidentally, they may cause digestive discomfort, including bloating, abdominal pain, or even constipation. Ingesting whole seeds without properly chewing them could potentially lead to obstruction in the digestive tract.

3. Potential Carcinogenic Effects

Some studies have suggested that custard apple seeds contain acetogenins, a group of compounds that have been shown to have cytotoxic and anti-cancer

properties in laboratory conditions. However, there is a lack of sufficient evidence to conclusively determine their safety in human consumption. In some cases, long-term or high-dose consumption of acetogenins could potentially have adverse health effects, including being carcinogenic.

4. Allergic Reactions

While rare, some individuals may experience allergic reactions to the seeds of the custard apple. Symptoms of an allergic reaction could include skin rashes, swelling, or respiratory distress. This is typically more common in people with sensitivities to other fruits in the Annonaceae family. Custard apple (also known as Cherimoya or Annona) seed oil is extracted from the seeds of the fruit and is gaining popularity due to its potential health and cosmetic benefits. The extraction process generally involves cold pressing or solvent extraction. Here's a detailed procedure for extracting the oil from custard apple seeds:

Extraction procedure for Custard Apple Seed Oil:

Materials Needed:

- Custard apple seeds
- Water (for cleaning)
- Blender or grinder (for crushing)
- Cold press machine (for cold pressing method) or solvent (for solvent extraction)
- Filter or cheesecloth (for filtration)
- Storage container (preferably glass)²²

Step-by-Step Procedure for Custard Apple Seed Oil Extraction:

1. Collection and Cleaning of Seeds:



Fig 4: Clean Custard Apple Seed

- **Collect the seeds:** After eating the custard apple, collect the seeds. It's advisable to dry the seeds first to prevent mold growth.
- **Cleaning:** Rinse the seeds under clean, cool water to remove any pulp or residue.
- **Drying:** Lay the cleaned seeds out in the sun to dry for a few days or use a dehydrator. The seeds need to be completely dry before extraction to avoid moisture content, which can affect the oil yield²³.

2. Preparation of the Seeds:

- Once dried, you need to crack open the seeds. Custard apple seeds have a hard shell, so they may require some effort to break.
- **Grind the seeds:** After cracking, use a blender or grinder to crush the seeds into a fine paste or powder. This will increase the surface area and allow better extraction of oil.

3. Oil Extraction Methods:

A. Cold Press Extraction (Preferred for retaining the natural properties of the oil)

Cold pressing is the most efficient and simplest way to extract oil while retaining its natural nutrients.

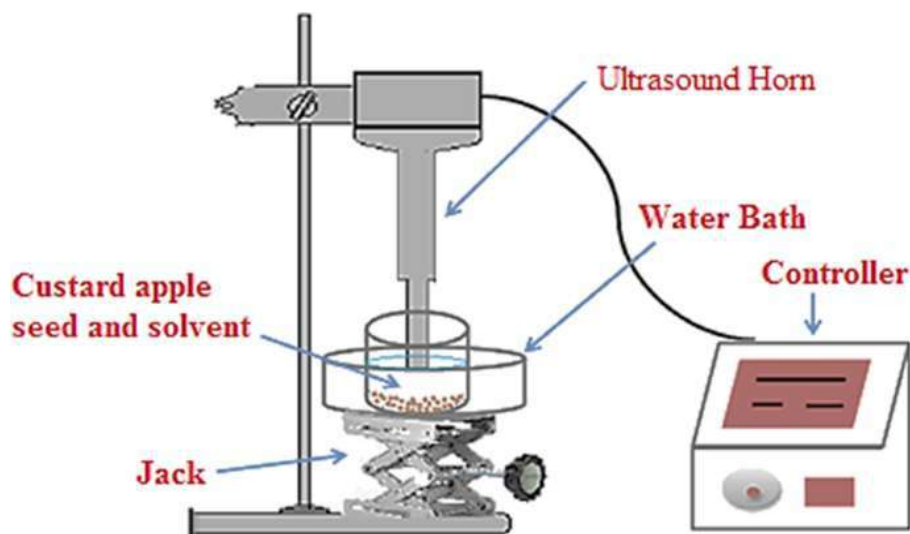


Fig 5: Cold Press Extraction

- **Setup the cold press machine:** If you have access to a cold press or hydraulic press, this is the best option.
- **Add crushed seeds:** Place the crushed custard apple seed paste into the press.
- **Pressing:** Apply pressure to extract the oil. The oil will flow out as a liquid while the solid residue (called cake) will remain inside the press.
- **Collect the oil:** Collect the oil in a clean container. You can filter the oil through a fine sieve or cheesecloth to remove any remaining seed particles.

B. Solvent Extraction (If cold pressing is not an option)

If you do not have access to a cold press, solvent extraction is another method, but this process may

leave traces of the solvent in the final product, so ensure that you use a food-safe solvent.

- **Crush the seeds:** As mentioned earlier, grind the custard apple seeds into a fine paste or powder.
- **Solvent choice:** Use a food-grade solvent like hexane or ethanol. These are typically used for oil extraction, but make sure the solvent is safe for human use or easily evaporates after extraction.
- **Mix the paste and solvent:** Combine the seed paste with the solvent in a container. Stir the mixture well and let it sit for several hours (usually 6-8 hours).
- **Filter the mixture:** After the solvent has dissolved the oil, filter out the solid residues using cheesecloth or a fine mesh strainer.

- **Evaporate the solvent:** Once you have the oil, place it in a well-ventilated area to allow the solvent to evaporate. You may also use low heat to speed up the evaporation process, but make sure to avoid overheating, as it can degrade the oil.
- **Final filtration:** Once the solvent is removed, filter the oil again to ensure it is free of impurities²³.

4. Storing the Oil:



Fig 6: Storage of oil

- Transfer the extracted oil into a dark glass **bottle** or an airtight container.
- Store the oil in a cool, dark place away from direct sunlight. Properly stored, custard apple seed oil can last for several months²⁴.

Benefits of Custard Apple Seed Oil:

- **Skin Care:** Rich in antioxidants, fatty acids, and vitamins, it is believed to help moisturize, soothe, and rejuvenate the skin. It may also help reduce the appearance of fine lines, wrinkles, and blemishes.
- **Hair Care:** It is sometimes used as a treatment for dry, brittle hair and scalp issues.

Anti-inflammatory: The oil contains compounds that may have anti-inflammatory properties, making it useful in massage oils or skincare products for soothing irritated skin²⁵.

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