Quinoa-based Biopesticide

Quinoa is grown in the Andean region from Colombia south to the northern part of Argentina. Depending on its variety, quinoa is cultivated at sea level or in the highlands, and its intensive farming has produced plants measuring less than 1 m with high yields per seed.

In all parts of the quinoa plant saponins can be found, but more commonly on the first layer. Saponins are a defense mechanism to protect quinoa from birds and insects, and they can also inhibit the growth of pathogenic fungi. Thus, quinoa's saponins have the potential to be used as a natural fungicide to control phytopathogen fungi that harm crops. There are two extraction methods to obtain saponins[1]:

1. Conventional: maceration, Soxhlet extraction and reflux extraction.
2. Non-Conventional: ultrasound, microwaves and accelerated solvent extraction.

Biopesticides produced from natural elements, such as saponins, are capable of preventing the effects that fungi, plagues and insects have on fruit and vegetables, while being safe for human health, affordable, biodegradable and innovative[2].

The organic nature of these types of pesticides would not harm the environment; they favor agriculture by reducing the economic losses caused by microbial phytopathogens and avoid the use of synthetic pesticides[3].

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[1] Zapana F, De Bruijn J y Aqueveque P, 2019. "Aplicación de la Saponina de Quinua (Chenopodium quinoa Willd) como agente antifúngico en frutas y hortalizas". Universidad de Concepción. Concepción, Chile.

[2] Bonifaz E., 2010. "Determinación de la actividad insecticida de la saponina de quinua (Chenopodium quinoa) hidrolizada y no hidrolizada sobre Drosophila melanogaster". Escuela Superior Politécnica de Chimborazo. Riobamba, Ecuador.

[3] Id.

Banana-Fiber Paper

Paper consumption worldwide amounts to 115 billion sheets of paper each year, and a per capita consumption of 49 kg. Statistics still continue to show a dire reality: 35% of felled trees are used for paper-making purposes, and only 16% of cellulose pulp comes from cultivated areas, and the rest is extracted from virgin forests. In total, 90% of cellulose used to manufacture paper comes from trees, leaving a trail of destruction[1].

Alternatives should be researched to replace this demand for paper. As a top banana producer, Ecuador has the potential to change this by using banana residues, such as finch. This part of the branch is high in fiber, and has been used to make paper in other parts of the world, which is an indication of the potential of this raw material abundant in Ecuadorian banana plantations[2].

Production of residue-based paper brings benefits such as[3]:

1. Residues are reused, avoiding waste disposal problems
2. They are affordable and abundant
3. New jobs are created
4. It requires basic machinery
5. It promotes sustainability

The banana paper-making process takes place as follows[4]:

1. Gather the recycled paper and banana plant residues
2. Chop the stems of the banana plant
3. Cut the stems into smaller pieces and grind them up
4. Wash the fibers
5. Place the recycled paper in a pulper. Add water until paper dissolves. This fiber will constitute the base for the paper
6. Mix the fiber of the recycled paper with the banana residues with the help of an irrigation system placed on a sifter that keeps the pulp suspended from these fibers
7. The pulp coils around a type of industrial roller, and then continues on to an absorbing band, which will dry the paper

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[1] Piguave L., 2018. Propuesta de fabricación de hojas de papel a partir de residuos de plátanos (musa paradisiaca) como alternativa ecológica a la tala de árboles. Universidad Laica Eloy Alfaro de Manabí. pp. 1
[2] Ibid. pp. 2
[3] Ibid. pp. 11
[4] Vikaspedia. Eco-paper Production. https://vikaspedia.in/agriculture/farm-based-enterprises/value-added-products/ecopaper-production-1. Access on 15.02.2021

Rice Paper

Rice is the second most produced cereal worldwide and part of the basic diet of many cultures around the globe. As a result, its production offers residues that should be used efficiently. Rice paper is the classification given to paper obtained from different parts of the rice plant, such as the rice straw. The same term applies to paper made out of hemp, bamboo and mulberry fibers[1].

Residues from rice production amount to 800 tons in Ecuador, and their disposal poses a real challenge to the environment. Most residues are burned, thus polluting the air while another part ends up in streams, which causes sedimentation and blocks irrigation channels. The use of rice residues as compost is not an option as it actually harms crops due to its high concentration of chemicals[2].

New alternatives should be found to use the excessive amount of residues caused by rice production. We present the process below to create rice paper with the following steps[3]:

Cellulose Extraction: The rice straw undergoes an assimilation process, mixed with water and sodium hydroxide subjected to 98ºC. A cellulose paste is obtained that should not be whitened in order to avoid any pollutants.

Molding: The wet paste is transferred to molding plates to give it its shape via a thermoforming procedure, that will provide us with an almost dry final product.

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[1] Serrano Párraga, Miguel., Córdova Cujilán C., 2015. Análisis Socioeconómico de la Viabilidad de la Fabricación de Papel a Base de Paja de Arroz en el Cantón Daule, Provincia del Guayas. pp. 21

[2] Ibid. pp. 6

[3] Ibid. pp. 30-31