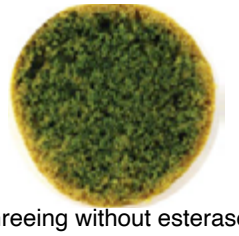
CHAPMAN UNIVERSITY | Office of Research

Enzymatic Break Down of Chlorogenic Acid in Sunflower Meal and Butter for Baking Chapman Case #2022-004

Market Need

Sunflower seeds are high in protein, healthy fats and minerals, are gluten free, and non-allergenic. Due to these properties, sunflower meal and butter, both of which are derived from sunflower seeds, could be developed into popular baking ingredients for health-conscious consumers, especially those with food allergies and gluten intolerance. However, sunflower seeds contain a high concentration of chlorogenic acid (CGA). Left untreated, baked goods such as cookies and bars that are made with sunflower butter and meal, would be green in color due to chemical reactions between the CGA and other molecules in the dough. Except for rare occasions where green baked goods are sought after, consumers normally would find green baked goods unappealing. To enable the widespread use of sunflower meal and butter in baking, there is a need for a treatment process that prevents the greening reaction. Several methods exist to prevent greening, however, each have important limitations. They use synthetic chemicals, only work at acidic pH, or remove health-beneficial phenolic compounds. To date, there is no way to eliminate greening without compromising sunflower flour and butter utility.



Greeing without esterase
VS

Non-green with esterase enzyme

Chapman Solution

Dr. Lilian Were Senger, Dr. Cedric Owens, and Ms. Christine Lo Verde of Chapman University have invented a novel method of mass-producing a CGA esterase from the bacterial genus Lactobacillus. This esterase breaks down CGA found in sunflower seeds into caffeic and quinic acids. Furthermore, this method also works to break down CGA in other CGA rich foods such as coffee beans. The inventors demonstrated that CGA esterase treatment of sunflower butter and meal prevents greening in baked foods made with sunflower meal and butter, and removes CGA from coffee beans. This method does not diminish the total phenolic content in the baked good, does not use harsh chemicals, and can be applied to baking applications at any pH. Furthermore, when compared with other CGA esterases that have been described in the literature, notably those from fungi, the esterase from Lactobacillus would be commercially superior because it not only is more catalytically active, but can also be generated in larger quantities and in shorter amounts of time.

Applications

- De-greening of baked goods made with sunflower-derived products such as sunflower meals and butter
- De-greening of high pH sunflower-dervied protein powders
- Removal of CGA in coffee beans to lower the bitterness of the coffee
- Production of caffeic and quinic acids from sunflower seeds and coffee beans
- Production of CGA esterase for food manufacturing

Key Publication

- A highly active esterase from Lactobacillus helveticus hydrolyzes chlorogenic acid in sunflower meal to prevent chlorogenic acid induced greening in sunflower protein isolates. Food Research International. December 2022.

Intellectual Property

- Patent application filed

Stage of Development

- Lab-scale production of the CGA esterase from Lactobacillus and demonstrations of the de-greening of sunflower meals, butter, and protein powder
- Available for licensing and further research collaborations

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