WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Rancidity in food

Bisman Lehal*

University Institute of Chemical Engineering and Technology, Sector 14, Chandigarh, India

A B S T R A C T

The process of rancidification is discussed in this study. The main focus is on the factors that influence rancidity and how preventative actions can be taken to avoid this process. When lipids (fats and oils) become rancid, they lose their nutritional value and have a rotten flavour and odour. This can cause a slew of negative consequences and diseases in humans. In order to determine the shelf life of a product, proper rancidity testing is requi red like the Peroxide value (PV) and Anisidine value (AnV).

Keywords: Antioxidants, Oils, Oxidation, Rancidity

1. Introduction

Rancidity is the natural process of decomposition of fats or oils leading to the development of undesirable flavor and odor by either hydrolysis or oxidation, or both.

Rancidity can be classified into three major types:

Oxidative rancidity:

Oxidative rancidity is a reaction that causes oxygen damage to a food item. The natural oil structure is disrupted and destroyed by oxygen molecules, resulting in colour, odour, and taste changes. Toxic chemicals, such as peroxides, occur as a result of oxidative rancidity, destroying vitamins A and E in meals. Polymeric materials and oxidised sterols are also produced.

Hydrolytic rancidity:

Hydrolytic rancidity generally causes an unpleasant odour. The release of free fatty acids from glycerides is the cause of this. Triglycerides are a compound made up of three fatty acids that are found in oily meals. They create glycerol and release free fatty acids that are not acceptable for human ingestion when they react with water. These fatty acids may also be subjected to oxidative rancidification, resulting in the formation of hazardous chemicals.

Ketonic rancidity:

This type of rancidity is most frequently encountered as a result of action of fungi such as *Aspergillusniger* and blue-green mold, *Pencilliumglaucum* on coconut or other oil seeds.

The tallowodour developed may be due to aldehydes or ketones formed due to the action of enzymes present in fungi or oil.

The essential prerequisites for the formation of ketonic rancidity appear to be:

Low water activity

Low partial pressure of oxygen

Rancidity reactions typically occur in three steps:

1. An energy source (heat; light) creates a radical on the fatty acid in the initiating process. A radical is an atom, molecule, or ion with an unpaired electron by definition. This increases the chemical reactivity of the "radical."
2. A step in which oxygen produces peroxides, which react with additional unsaturated fatty acids to produce new radicals.
3. Two radicals engage to generate a new single bond in a termination reaction.

* *Corresponding author*. Tel.: +0-000-000-0000 ; fax: +0-000-000-0000.
E-mail address: author@institute.xxx

Fats, oils, and other lipids are decomposed at the end of rancidification, thus forming highly reactive molecules. These are the culprits behind rotten foods' foul odour and flavour. Rancidification can cause the loss of vitamins in food in rare situations.

Here introduce the paper, and put a nomenclature if necessary, in a box with the same font size as the rest of the paper. The paragraphs continue from here and are only separated by headings, subheadings, images and formulae. The section headings are arranged by numbers, bold and 9.5 pt. Here follows further instructions for authors.

1.1. Materials and Methods

Factors Affecting Rancidity and Reversion:

1. Oxidation:

Because lipids are eight times more soluble in oxygen than water, the oxidation that results from this exposure is the primary source of rancidity. Unsaturated fats are oxidised largely through a free radical-mediated mechanism. These chemical reactions can produce highly reactive molecules in rancid foods and oils, which are responsible for creating foul smells and flavonoid compounds.Auto-oxidation, often known as oxidative rancidity, is the name given to this process.

2. Hydrolysis:

Under the right conditions, triglycerides react with water to generate diglycerides and free fatty acid residues. Monoglycerides and fatty acids are formed when diglycerides mix with water. Finally, the monoglycerides hydrolyzed entirely, yielding glycerol and fatty acids. This process is called hydrolytic rancidity.

3. Presence of Microorganisms – Microbial Lipase:

Lipase is a hydrolytic enzyme produced by certain bacteria that directly interferes with the breakdown of triglycerides to create glycerols and fatty acids. These fatty acids become rancid due to auto-oxidation. For its activity on fats and oils, microbial lipase requires the right pH and other conditions.

4. Presence of Unsaturation in Fatty Acid Chain:

When unsaturated components of a fatty material are exposed to air, hydroperoxides occur, which then break down into volatile aldehydes, esters, alcohols, ketones, and hydrocarbons, some of which have unpleasant odours. Butter becomes rancid due to the aforementioned process, as well as hydrolysis, which releases volatile and malodorous acids, primarily butyric acid. At room temperature, saturated fats like beef tallow resist oxidation and turn rancid.

5. Polyunsaturation:

The higher the polyunsaturation of a fat, the faster it goes rancid. Animal fats must go rancid at a much faster rate than vegetable oils. Polyunsaturated fatty acids are more susceptible to rancidity than monosaturated and other types of saturated fatty acids in oils and fats.

6. Chemical Structure of Oils and Fats:

Oils and fats with a higher number of double bonds, carboxyl, or hydroxyl groups have a higher risk of becoming rancid. The double bonds contained in fats and oils enhance auto-oxidation. Auto-oxidation is more common in oils with a high unsaturation content. In the auto-oxidation reaction, peroxides are intermediates. An oil's or fat's peroxide value is used to measure how far rancidity reactions have progressed during storage.

7. Temperature and pH:

These are the main causes of rancidity in fat- and oil-rich meals. Microbial lipase's hydrolytic function necessitates a certain temperature and alkaline pH. Temperature and pH influence auto-oxidation and hydrolysis in an indirect manner.

8. Heat and Light:

Heat and light intensify the reaction of lipids with oxygen, i.e. heat hastens auto-oxidation. Heat and light drive the production of free radicals in rancidity and reversion of oils and fats.

1.2. Prevention

Adding inert gases, such as nitrogen, which does not react with oxygen, can be added to the packet or container. Example So that the chips don't go rancid, they're flushed with nitrogen gas.

Adding antioxidant: Antioxidants are added to some foods to slow down or eliminate oxidative deterioration.

There are five types of antioxidants:

(1) **Natural antioxidants:** Tocopherols (vitamin E), flavonoids, polyphenols, ascorbic acid (vitamin C)

(2) **Synthetic antioxidants:**

BHT – butylated hydroxyl toluene
BHA- butylated hydroxyl anisole
TBHQ- tertiary butyl hydroquinone
EDTA-ethylene diamine tetra acetic acid

(3) **Semi-synthetic antioxidants** – gallic acid, propylgallate.

(4) **Metal chelators** – citric acid, phosphoric acid.

(5) **Oxygen scavengers** – ascorbic acid.

Natural antioxidants have a short shelf life, whereas synthetic antioxidants have a longer shelf life and better action

Refrigeration: To lower the temperature and so prevent germs from continuing their operations.

The purpose of vacuum packaging is to keep oxygen out. Oxygen scavengers or oxygen absorbers are added to enclosed packaging to assist eliminate or minimise the amount of oxygen. They're used to keep products safe while also extending their shelf life.

Food should be stored in airtight containers to avoid rancidity.By storing food in a cool, dark location with little exposure to oxygen or free radicals, rancidification can be reduced. Heat and light enhance the rate of lipids reacting with oxygen, thus storing fats and oils in a cold, dark place with little exposure to oxygen or free radicals can help.

2. Discussion

Measuring rancidity:
Rancidity is most commonly detected by taste or smell, but is also accompanied by a marked increase in the acid value of the fat, which is tested by using **two basic tests**:
Peroxide value (PV): is the measure of peroxides contained in the oil. The peroxides are determined by titration against thiosulphate in the presence of KI. Starch is used as indicator.
Anisidine value (AnV): assess the secondary oxidation of oil or fat , which is mainly imputable to aldehydes and ketones and is therefore able to tell the oxidation history of an oil or fat.
Harmful effects of rancid food:Leads to deficiencies such as anaemia, hair loss and dermatitis.Kidney and heart disease, Nuerodegeneration and Cancer.

3. Conclusion

To combat the process of rancidification, effective steps should be implemented. Antioxidants can help to avoid the loss of important vitamins found in diet. The process of can also alter the nutritional content of substances, resulting in a variety of deficits in humans. As a result, determining the shelf life of items is critical in order to minimise harmful consequences.

REFERENCES

NPTEL :: Agriculture - NOC:Novel Technologies for Food Processing and Shelf Life Extension. (n.d.). Https://Nptel.Ac.in/Courses/126/105/126105015/. Retrieved September 2, 2021, from https://nptel.ac.in/courses/126/105/126105015/

Anand, J. (2020, October 13). What Is Rancidity? Science ABC. https://www.scienceabc.com/pure-sciences/what-is-rancidity.html

Sarin, N., & Profile, V. M. C. (2019, January 29). *UNIT - 3 FATS AND OILS*. Http://Foodsciencehm.Blogspot.Com/2019/01/Unit-3-Fats-and-Oils.Html?M=1. http://foodsciencehm.blogspot.com/2019/01/unit-3-fats-and-oils.html?m=1

S, M. (2018, August 1). Rancidity of Food: Introduction, Types, Factors and Prevention of Rancidity | Food Chemistry | Biotechnology. BioTechnology Notes. https://www.biotechnologynotes.com/food-biotechnology/food-chemistry/rancidity-of-food-introduction-types-factors-and-prevention-of-rancidity-food-chemistry-biotechnology/14100

Rancidity. (n.d.). BrainKart. Retrieved September 2, 2021, from https://www.brainkart.com/article/Rancidity_33984/