



# SNS COLLEGE OF TECHNOLOGY

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## SURFACTANTS - TYPES

In the context of food additives, a surfactant is a substance that helps to improve the texture, stability, and overall quality of food products. Surfactants in food act by reducing surface tension, which facilitates the mixing of ingredients that typically do not combine well, such as oil and water.

Key Functions of Surfactants in Food:

1. **Emulsification:** They help stabilize emulsions, such as salad dressings and mayonnaise, by preventing the separation of oil and water.
2. **Foaming:** Some surfactants contribute to the formation and stability of foam in products like whipped toppings or mousses.
3. **Wetting:** They enhance the wetting properties of ingredients, which can improve texture and mouthfeel in various food products.
4. **Stabilization:** Surfactants help maintain the stability of food products by preventing the separation of ingredients during storage.

Common Types of Food Surfactants:

- **Lecithin:** A natural emulsifier derived from soy or egg, often used in chocolates and baked goods.
- **Polysorbates:** Synthetic emulsifiers commonly found in ice creams and dressings.
- **Sorbitan esters:** Used in baked goods and margarine to improve texture and shelf life.

Surfactants in food additives are generally regarded as safe when used within recommended limits, and they play a crucial role in enhancing food quality and consumer experience.

Surfactants can also be categorized based on their purpose and application. Here are some common types based on their function:

1. **Detergents:** Used for cleaning purposes, these surfactants help remove dirt and grease. Common examples include anionic surfactants like sodium lauryl sulfate.
2. **Emulsifiers:** These help mix two immiscible liquids, such as oil and water, creating stable emulsions. Nonionic surfactants like polysorbates are often used in food and cosmetics.
3. **Foaming Agents:** Used to produce foam in products like shampoos and bubble baths. Anionic and nonionic surfactants are typically employed here.
4. **Wetting Agents:** These reduce surface tension, allowing liquids to spread more easily over surfaces. Used in agricultural applications and coatings, examples include nonionic surfactants.
5. **Dispersants:** Used to keep solid particles suspended in liquids, preventing settling. Common in paints and coatings, they are often nonionic or anionic.
6. **Antistatic Agents:** These reduce static electricity buildup on surfaces, commonly used in textiles and electronics. Cationic surfactants are often used for this purpose.
7. **Conditioners:** Used in hair and fabric products to improve texture and feel. Cationic surfactants, such as quaternary ammonium compounds, are frequently used.
8. **Solubilizers:** Help dissolve active ingredients in formulations, particularly in pharmaceuticals and cosmetics. Nonionic surfactants are often employed for this purpose.

9. Stabilizers: Maintain the stability of emulsions and suspensions over time. They can be nonionic or anionic, depending on the formulation.

Each type of surfactant plays a specific role, enhancing the performance of products across various industries.

## EMULSIFIER

Emulsifiers are food additives that help stabilize mixtures of oil and water, which typically do not mix well. They are crucial in the food industry for creating smooth, homogenous products. Here's an overview of their role, working principle, mechanism, examples, and usage. Emulsifiers are substances that help create and maintain emulsions by reducing the surface tension between the oil and water phases.

### DEFINITION

In the context of the Food Safety and Standards Authority of India (FSSAI), an emulsifier is defined as a food additive that facilitates the mixing of immiscible liquids, particularly oil and water.

### Functions:

- **Stabilization:** They prevent the separation of oil and water in food products like sauces, dressings, and dairy products.
- **Texture Enhancement:** Emulsifiers contribute to the creaminess and mouthfeel of products, making them more palatable.
- **Improvement of Shelf Life:** By stabilizing emulsions, they help extend the shelf life of products, reducing spoilage.

**Types of Emulsifiers:** FSSAI recognizes various emulsifiers, which can be categorized as:

- **Natural Emulsifiers:** Such as lecithin (from egg yolk or soy) and casein (from milk).
- **Synthetic Emulsifiers:** Such as mono- and diglycerides, and polysorbates.

**Regulations:** FSSAI sets standards for the permissible limits and labeling of emulsifiers in food products to ensure safety and consumer awareness.

### 1. Permissible Limits

- **Maximum Levels:** FSSAI specifies maximum permissible levels for various emulsifiers in different food categories. These limits are based on safety assessments and are designed to prevent excessive intake.
- **Specific Emulsifiers:** The regulations detail specific emulsifiers that are allowed, along with their acceptable daily intake (ADI) values.

### Safety Assessments

- **Scientific Evaluation:** FSSAI conducts scientific evaluations of emulsifiers to assess their safety for consumption, considering factors such as toxicology, allergenicity, and potential health impacts.
- **Regular Review:** The safety evaluations are periodically reviewed to incorporate new research findings.

### Role of Emulsifiers

1. **Stability:** Emulsifiers prevent the separation of oil and water phases in products like salad dressings and sauces.
2. **Texture Improvement:** They enhance the mouthfeel and creaminess of foods, making them more appealing.
3. **Shelf Life Extension:** By stabilizing emulsions, they can help extend the shelf life of products by preventing separation and spoilage.
4. **Improved Appearance:** Emulsifiers contribute to a uniform appearance, making products visually appealing.

### Working Principle and Mechanism

Emulsifiers work based on their unique chemical structure. They are typically amphiphilic molecules, meaning they have both hydrophilic (water-attracting) and hydrophobic (water-repelling) properties.

1. **Molecular Structure:** An emulsifier molecule has a hydrophilic head that interacts with water and a hydrophobic tail that interacts with oil. This dual nature allows them to reduce the surface tension between the two immiscible phases (oil and water).

## 2. Emulsion Formation:

- Dispersion: When an emulsifier is added to a mixture of oil and water, it disperses throughout the mixture.
- Stabilization: The emulsifier molecules position themselves at the oil-water interface, with their hydrophilic heads in the water and their hydrophobic tails in the oil. This creates a protective barrier around the dispersed oil droplets, preventing them from coalescing (coming together).

## FUNCTION

Here's a comprehensive overview of the functions of emulsifiers used in food, detailing how they enhance product quality, stability, and sensory attributes.

### 1. Formation of Stable Emulsions

#### Mechanism:

- Emulsifiers consist of hydrophilic (water-attracting) and hydrophobic (water-repelling) portions. When mixed with oil and water, the hydrophobic part interacts with oil, while the hydrophilic part interacts with water.

#### Benefits:

- This arrangement helps stabilize mixtures that would otherwise separate, such as oil and vinegar in salad dressings or mayonnaise.

### 2. Reduction of Surface Tension

#### Mechanism:

- Emulsifiers lower the surface tension at the interface of oil and water, making it easier to create and maintain smaller droplets.

#### Benefits:

- Smaller droplets lead to more stable emulsions, reducing the likelihood of separation and improving overall product stability.

### 3. Improved Texture and Mouthfeel

#### Mechanism:

- Emulsifiers help create a uniform dispersion of fat and water, contributing to a smoother texture.

#### Benefits:

- In products like ice cream, sauces, and creams, emulsifiers enhance creaminess, providing a more enjoyable mouthfeel and overall sensory experience.

### 4. Flavor Distribution and Enhancement

#### Mechanism:

- Emulsifiers stabilize the emulsion, allowing for the even distribution of flavors and aromas within the product.

#### Benefits:

- This uniformity ensures that flavors are consistent throughout the product, enhancing the taste experience.

### 5. Control of Viscosity

#### Mechanism:

- Emulsifiers can influence the rheological properties of food products, impacting how thick or thin they are.

#### Benefits:

- Adjusting viscosity is crucial for consumer preferences, making products easier to pour, spread, or dip.

### 6. Shelf Life Extension

#### Mechanism:

- By maintaining stability and preventing phase separation, emulsifiers help protect against spoilage and degradation.

#### Benefits:

- Longer shelf life means reduced food waste and improved economic viability for manufacturers.

### 7. Fat Reduction in Formulations

#### Mechanism:

- Emulsifiers can stabilize lower-fat formulations by allowing water to replace some of the fat while still maintaining texture and mouthfeel.

Benefits:

- This allows manufacturers to create healthier products without sacrificing sensory qualities, catering to consumer demands for healthier options.

#### 8. Heat Stability

Mechanism:

- Some emulsifiers provide stability to emulsions during cooking or processing, resisting separation under heat.

Benefits:

- This is particularly important in sauces and soups that undergo heating, ensuring they maintain a desirable consistency.

#### 9. Prevention of Coalescence

Mechanism:

- Emulsifiers form a film around dispersed droplets, preventing them from merging.

Benefits:

- This reduces the risk of large droplet formation, which can lead to product separation and an undesirable appearance.

#### 10. Foam Stabilization

Mechanism:

- Emulsifiers can stabilize air bubbles in foamed products, like whipped cream or mousses, by forming a film around the bubbles.

Benefits:

- This helps maintain the structure of the foam over time, preventing collapse and ensuring product consistency.

#### 11. Synergy with Other Ingredients

Mechanism:

- Emulsifiers can enhance the effectiveness of other ingredients, such as stabilizers and thickeners, by improving the overall emulsion structure.

Benefits:

- This collaborative effect can lead to better texture, stability, and quality in complex formulations.

#### 12. Prevention of Crystallization

Mechanism:

- In products like ice cream, emulsifiers inhibit the formation of ice crystals by interfering with crystal growth.

Benefits:

- This results in a smoother texture and improved mouthfeel, which is critical for frozen desserts.

Emulsifiers are indispensable in the food industry, playing multiple roles that contribute to the overall quality, stability, and sensory experience of food products. By carefully selecting and formulating with emulsifiers, food manufacturers can enhance product appeal while meeting consumer demands for texture, flavor, and shelf life.

### 3. Types of Emulsions:

- Oil-in-Water (O/W): Oil droplets are dispersed in a continuous water phase (e.g., milk, mayonnaise).
- Water-in-Oil (W/O): Water droplets are dispersed in a continuous oil phase (e.g., butter, margarine).

#### Examples of Emulsifiers

1. Lecithin: A naturally occurring emulsifier found in egg yolks and soybeans. Commonly used in chocolates, dressings, and baked goods.
2. Monoglycerides and Diglycerides: These are derived from glycerol and fatty acids. They are used in baked goods, margarine, and spreads to improve texture and shelf life.
3. Polysorbates (e.g., Polysorbate 80): Synthetic emulsifiers used in ice creams, salad dressings, and sauces to stabilize emulsions.
4. Sodium Stearoyl Lactylate: Often used in bread and baked goods to improve dough stability and texture.

#### Usage in Food Products

- Dairy Products: Emulsifiers are used in cream, ice cream, and cheese to enhance texture and prevent separation.
- Baked Goods: They improve dough handling, crumb structure, and shelf life in breads, cakes, and pastries.
- Sauces and Dressings: Emulsifiers stabilize oil and vinegar mixtures, providing a consistent texture and preventing separation.
- Confectionery: In chocolates, emulsifiers enhance smoothness and reduce viscosity for better coating and molding.

## EXAMPLES

### 1. Dairy Industry

- **Lecithin:** Found in milk and cream, used in ice creams and chocolate.
- **Mono- and Diglycerides:** Used in cream cheese and yogurt to improve texture and stability.

### 2. Bakery Industry

- **Sodium Stearoyl Lactylate:** Used in bread and baked goods to enhance dough stability and volume.
- **Mono- and Diglycerides:** Commonly used in cakes and pastries to retain moisture and improve crumb structure.

### 3. Sauces and Dressings

- **Polysorbate 80:** Used in salad dressings and mayonnaise to stabilize oil and vinegar emulsions.
- **Xanthan Gum:** A natural emulsifier used in sauces for thickening and stability.

### 4. Confectionery Industry

- **Lecithin:** Used in chocolate to improve fluidity and prevent fat bloom.
- **Sorbitan Monostearate (Span 60):** Used in various confectionery products to stabilize emulsions.

### 5. Frozen Foods

- **Sodium Stearoyl Lactylate:** Often used in frozen baked goods for better texture.
- **Polysorbate 20:** Used in ice creams to prevent ice crystal formation.

### 6. Meat Products

- **Sodium Phosphate:** Used in processed meats to enhance moisture retention and texture.
- **Lecithin:** Used in emulsified sausage products to improve consistency.

### 7. Plant-Based Foods

- **Sunflower Lecithin:** Used in vegan products such as plant-based milks and spreads.
- **Guar Gum:** Used in vegan dressings and sauces as an emulsifier and thickening agent.

### 8. Beverages

- **Polysorbate 80:** Used in flavored beverages to ensure uniform distribution of flavors and oils.
- **Lecithin:** Sometimes used in protein drinks to improve texture and emulsification.

These examples highlight the versatility of emulsifiers across various food industries, each serving to improve stability, texture, and overall product quality.

**HLB VALUE**

A tenside with a relatively strong lipophilic group and weak hydrophilic group is mainly soluble in oil and preferentially stabilizes a w/o emulsion, and vice versa. This fact led to the development of a standard with which the relative strength or “activity” of the hydrophilic and lipophilic groups of emulsifiers can be evaluated. It is called the HLB value (hydrophilic–lipophilic balance).

**STABILIZERS**

As per the Food Safety and Standards Authority of India (FSSAI), stabilizers are defined as substances that are added to food products to maintain their physical and chemical stability, preventing separation or changes in texture. They help to enhance the viscosity and consistency of food items, ensuring that the product remains uniform throughout its shelf life. Stabilizers can be derived from natural or synthetic sources and are used in various food applications, including dairy products, sauces, and desserts.

**TYPES OF STABILIZERS AS PER FSSAI**

The Food Safety and Standards Authority of India (FSSAI) recognizes several types of stabilizers used in food products. Here are some common categories:

**1. Hydrocolloids**

- **Examples:** Agar-agar, gelatin, pectin, xanthan gum, guar gum.
- **Function:** These natural polysaccharides are used to thicken and stabilize emulsions, gels, and suspensions.

**2. Emulsifiers**

- **Examples:** Lecithin, mono- and diglycerides, polysorbates.
- **Function:** While primarily used for emulsification, many emulsifiers also contribute to the stability and texture of food products.

**3. Starch-Based Stabilizers**

- **Examples:** Modified starches, corn starch, tapioca starch.
- **Function:** Used to improve viscosity, provide texture, and stabilize products during cooking or processing.

**4. Proteins**

- **Examples:** Casein, whey protein, soy protein.
- **Function:** Proteins can act as stabilizers by forming gels or emulsions, enhancing texture and mouthfeel.

**5. Fat-Based Stabilizers**

- **Examples:** Shortening, margarine.
- **Function:** These fats can stabilize emulsions and provide a desirable texture in baked goods and spreads.

**6. Synthetic Stabilizers**

- **Examples:** Carrageenan, sodium alginate.
- **Function:** These are chemically modified substances that enhance stability and texture in processed foods.

**7. Gelling Agents**

- **Examples:** Agar, gelatin, carrageenan.
- **Function:** These agents create a gel-like consistency, providing stability and texture in desserts and jellies.

**Regulatory Context**

FSSAI provides guidelines on the permissible types and uses of stabilizers in food products to ensure safety and quality. Each stabilizer has specific conditions of use, which manufacturers must comply with.

For precise details, including permissible limits and specific applications, it's advisable to consult the official FSSAI documents and regulations.

## Functions of Stabilizers

Here's a comprehensive overview of the functions of stabilizers used in food, focusing on how they enhance product quality, stability, and overall sensory attributes.

### 1. Thickening Agents

Mechanism:

- Stabilizers increase the viscosity of food products by absorbing water and swelling, creating a thicker texture.

Benefits:

- This prevents separation of ingredients, enhances mouthfeel, and improves the overall texture in products like sauces, soups, and gravies.

### 2. Water Retention

Mechanism:

- Stabilizers bind water molecules, reducing the free water content in food products.

Benefits:

- This helps prevent syneresis (the release of liquid) in products like yogurt, custards, and dressings, maintaining desired consistency and moisture.

### 3. Prevention of Crystallization

Mechanism:

- Stabilizers inhibit the formation of crystals in sugar-containing products by interfering with crystal growth.

Benefits:

- This results in smoother textures in items like ice creams, syrups, and confections, preventing graininess and improving palatability.

### 4. Foam Stabilization

Mechanism:

- Stabilizers help maintain the structure of foams by creating a stable network around air bubbles.

Benefits:

- In whipped products like mousses and whipped cream, stabilizers prevent the collapse of the foam, ensuring that the product retains its volume and texture over time.

### 5. Texture Improvement

Mechanism:

- Stabilizers modify the rheological properties of food products, influencing their mouthfeel and overall texture.

Benefits:

- This enhancement is crucial in baked goods, dairy products, and sauces, contributing to a more appealing sensory experience.

### 6. Enhanced Product Consistency

Mechanism:

- Stabilizers ensure a uniform distribution of ingredients throughout a product, preventing sedimentation and separation.

Benefits:

- This consistency is vital for consumer acceptance and brand reliability, particularly in sauces, dressings, and dairy products.

#### 7. Synergy with Other Ingredients

Mechanism:

- Stabilizers can work alongside emulsifiers and thickeners to enhance overall stability and functionality.

Benefits:

- This collaborative effect improves the texture, stability, and quality of complex formulations, leading to better end products.

#### 8. Prevention of Phase Separation

Mechanism:

- Stabilizers create a more stable matrix that holds dispersed particles in suspension, reducing the tendency for separation.

Benefits:

- This is crucial in products like salad dressings and sauces, where separation can lead to undesirable appearance and texture.

#### 9. Improvement of Mouthfeel

Mechanism:

- By modifying viscosity and texture, stabilizers can enhance the mouthfeel of food products.

Benefits:

- A desirable mouthfeel is essential for consumer enjoyment, particularly in products like dairy, sauces, and desserts.

#### 10. Heat Stability

Mechanism:

- Certain stabilizers can withstand heat during cooking or processing, maintaining the stability of the food product.

Benefits:

- This is important for sauces and soups, ensuring they maintain a desirable consistency when heated.

#### 11. Enhanced Flavor Release

Mechanism:

- Stabilizers can influence how flavors are perceived by controlling the release and interaction of flavor compounds within the product.

Benefits:

- This contributes to a more intense and enjoyable flavor experience, especially in sauces and prepared meals.

#### 12. Shelf Life Extension

Mechanism:

- By preventing separation and maintaining texture, stabilizers can prolong the shelf life of food products.

Benefits:

- Extended shelf life reduces food waste and ensures that products remain appealing to consumers for longer periods.

Hence,

Stabilizers are essential food additives that enhance the quality, stability, and sensory experience of various food products. By understanding their functions and applications, food manufacturers can develop products that meet consumer expectations for taste, texture, and overall quality, while also extending shelf life and reducing waste.



## JECFA

JECFA stands for the Joint FAO/WHO Expert Committee on Food Additives. It is a committee established by the Food and Agriculture Organization (FAO) and the World Health Organization (WHO) to evaluate the safety of food additives, contaminants, and naturally occurring toxicants in food. The committee provides scientific advice and guidance to member countries and organizations on food safety issues, contributing to the development of international food standards.

## UNIT – 3

Food additives must meet safety standards that consider the levels at which they are likely to be consumed and the potential risk to human health. Here are some ways that food additives are regulated:

### Safety assessment

Food additives must undergo a safety assessment that considers the risk to human health. This assessment includes scientific reviews of biochemical, toxicological, and other relevant data.

- Acceptable daily intake (ADI)

The ADI is an estimate of how much of an additive can be safely consumed daily over a lifetime without adverse health effects.

- Good Manufacturing Practice (GMP)

Food additives should be used in accordance with GMP, which includes using the lowest possible level of the additive, and preparing and handling it like a food ingredient.

- Threshold of Regulation (TOR)

Substances that are present at levels below the TOR are exempt from regulation as food additives. However, carcinogens do not qualify for this exemption.