UNIT V – TOPIC 4

Desolventization and refining of oils

Desolventization and **refining** are critical steps in oilseed processing, particularly for oils extracted using solvent-based methods. These processes ensure that the extracted oil is safe, stable, and suitable for consumption or industrial use.

1. Desolventization

Desolventization is the process of removing residual solvent (commonly hexane) from oil and oilseed meal after solvent extraction. This step is crucial to ensure that the final products meet food safety standards and minimize solvent loss.

Key Steps in Desolventization

1. **Desolventization of the Meal**:
   - The extracted oilseed meal, which contains residual solvent, is heated to evaporate the solvent.
   - The solvent is then recovered for reuse in the extraction process.
2. **Desolventization of the Oil**:
   - Crude oil extracted via solvents is treated in a desolventizer, where heat and vacuum are applied to evaporate residual solvent.
   - This step ensures that the oil is safe for further refining.

Equipment Used:

- **Desolventizer-Toaster (DT)**:
  - Used to remove solvents from the meal while toasting it to improve its nutritional value.
  - Heat is applied, often through steam, to evaporate the solvent.
- **Vacuum Stripping Column**:
  - Utilized for the oil phase to remove residual solvent under reduced pressure.

Factors Affecting Desolventization:

- **Temperature and Pressure**: Higher temperatures and lower pressures increase the efficiency of solvent removal.
- **Time**: Adequate time ensures complete removal of solvents.
- **Moisture Content**: The addition of steam helps to strip off the solvent.

Importance:

- **Safety**: Removes traces of hazardous solvents, ensuring the product is safe for consumption.
- **Solvent Recovery**: Recovered solvents are reused in the process, reducing costs and environmental impact.

2. Refining of Oils

The refining process removes impurities, free fatty acids (FFAs), odors, and colors from crude oil, making it suitable for edible or industrial use.

Stages of Oil Refining

1. **Degumming**:
   - Removes phospholipids (gums) that can cause oil instability.
   - Methods include water degumming, acid degumming, and enzymatic degumming.
   - Outcome: Improved oil stability and quality.
2. **Neutralization** (or Alkali Refining):
   - Removes free fatty acids (FFAs) by treating the oil with an alkali (e.g., sodium hydroxide).
   - The reaction forms soapstock, which is separated from the oil.
   - Outcome: Reduced acidity and improved taste.
3. **Bleaching**:
   - Removes pigments, oxidation products, and trace metals.
   - Involves mixing the oil with adsorbents like bleaching earth or activated carbon and filtering them out.
   - Outcome: Light-colored oil with improved appearance.
4. **Deodorization**:
   - Removes volatile compounds that contribute to undesirable odors and flavors.
   - Steam distillation is performed under high vacuum and elevated temperatures (200–260°C).
   - Outcome: Neutral flavor and extended shelf life.
5. **Winterization** (Optional):
   - Used for oils like sunflower or cottonseed that contain waxes.
   - The oil is cooled to precipitate waxes, which are then filtered out.
   - Outcome: Clear oil, free from cloudiness when refrigerated.
6. **Fractionation** (Optional):
   - Separates oils into fractions based on their melting points, producing oils with different functional properties.
   - Common in palm oil refining.

Types of Refining

1. **Chemical Refining**:
   - Involves the use of chemicals (alkalis) to neutralize FFAs and remove impurities.
   - Suitable for oils with high levels of FFAs.
2. **Physical Refining**:
   - Utilizes steam distillation to remove FFAs and impurities without using chemicals.
   - More eco-friendly and preferred for oils with low FFA content (e.g., palm oil).

Challenges in Refining

- **Oxidation**: Prolonged exposure to heat and air during refining can lead to oxidation, reducing oil quality.
- **Loss of Nutrients**: Some refining steps (like bleaching and deodorization) may reduce the content of beneficial compounds like tocopherols and sterols.
- **Energy Consumption**: Refining involves energy-intensive steps like deodorization and bleaching.

Comparison of Crude and Refined Oils

Parameter	Crude Oil	Refined Oil
Appearance	Dark, turbid	Clear, light-colored
Taste and Odor	Off-flavors, natural seed smell	Neutral, bland
FFA Content	High	Low
Stability	Prone to rancidity	Stable, longer shelf life
Use	Industrial applications	Edible applications

Sustainability in Desolventization and Refining

- **Energy Efficiency**: Modern equipment is designed to reduce energy use during heating and vacuum operations.
- **Minimal Waste**: Soapstock and other by-products are processed into products like biodiesel or animal feed.
- **Green Refining Technologies**: Enzymatic degumming and physical refining reduce chemical usage and environmental impact.

Conclusion

Desolventization and refining are essential steps in oilseed processing to produce high-quality oils. Innovations in these areas aim to enhance efficiency, improve oil quality, and reduce environmental impacts, meeting the needs of both consumers and industrial users.