Heat Sensitivity of Plant Oils and Butters in Cosmetic Formulations

When working with plant oils and butters in cosmetic formulations, one of the most critical factors to consider is heat sensitivity. Excessive heat can cause oils and butters to degrade, lose beneficial properties, and even go rancid. Understanding how to handle these ingredients during the formulation process ensures product stability, shelf life, and efficacy.

Why Heat Matters for Oils and Butters

Plant oils and butters are rich in unsaturated fatty acids, vitamins, and antioxidants. These beneficial compounds are sensitive to high heat. When exposed to temperatures beyond their stability threshold:

• Oxidation accelerates, causing oils to go rancid faster.

• Fatty acids break down, reducing the oil's nutritive and conditioning properties.

• Natural antioxidants (like vitamin E) are destroyed, further reducing shelf life.

• Texture and aroma of the oil or butter may change, impacting the finished product.

Determining the Right Temperature

Each oil or butter has an approximate maximum safe heating temperature for formulation. A practical guideline is:

• Delicate oils (high in polyunsaturated fatty acids): Add at cool-down phase (below 40°C / 104°F).

• Moderately stable oils and butters: Can be gently heated if needed but ideally added below 45–50°C (113–122°F).

• Stable butters and saturated oils (shea, cocoa, coconut): Can withstand moderate heating during the oil phase (up to ~70°C / 158°F).

Heat Sensitivity and Iodine Value

In our blog post, 'Why a Cosmetic Formulator Needs to Know the Iodine Value in Plant Oils and Butters,' we explained how the iodine value reflects the degree of unsaturation in an oil or butter. This directly links to heat sensitivity:

• High iodine value (e.g., flaxseed, chia, hemp): Very heat-sensitive, short shelf life. Must be added at cool-down.

• Moderate iodine value (e.g., sunflower, almond): Somewhat stable, mild heating is acceptable.

• Low iodine value (e.g., cocoa butter, coconut oil, shea butter): Heat-stable, longer shelf life.

Best Practices for Formulators

• Use a double boiler or water bath to gently heat oils when necessary.

• Keep delicate oils for the cool-down phase (below 40°C).

• Add natural antioxidants like tocopherols (vitamin E) to extend shelf life.

• Store oils and butters properly in cool, dark conditions to minimize pre-oxidation before use.

• Consult suppliers for recommended processing temperatures for specialty oils.

Chart: Iodine Values and Safe Temperatures for Common Oils and Butters

Oil/Butter	Iodine Value (approx.)	Recommended Addition Temperature
Flaxseed Oil	170–200	Cool-down phase (<40°C)
Chia Seed Oil	190–199	Cool-down phase (<40°C)
Hemp Seed Oil	140–170	Cool-down phase (<40°C)
Rosehip Seed Oil	150–190	Cool-down phase (<40°C)
Grapeseed Oil	125–143	Cool-down phase (<40°C)
Sunflower Oil	110–143	Mild heat acceptable (<50°C)
Almond Oil	90–110	Cool-down or mild heat (<45°C)
Cocoa Butter	30–40	Heated oil phase (up to 70°C)
Shea Butter	45–70	Heated oil phase (up to 70°C)
Coconut Oil	30–40	Heated oil phase (up to 70°C)