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## The Science of Food Colours: Natural vs. Artificial

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Food colours play an important role in the food industry, which enhances the visual appearance of the products, shaping consumer preferences, and crafting sensory experiences that go beyond taste and smell. From the rich reds of candies to the refreshing greens of beverages, these colours are now included to our diets. However, these vibrant shades are not only a result of cooking or preparation; they are often linked to from agricultural practices and the use of food additives. In agricultural and food production, colours can originate naturally from crops or be artificially introduced during processing to boost their appearance.

As the global food industry adapts to evolving systems and changing consumer preferences, understanding the differences between natural and artificial food colours is becoming increasingly important. These bright colours may look similar, but there are key differences between them. These two types of colourants serve similar purposes but vary significantly in their origins, health implications, and regulatory oversight. By exploring these distinctions, we can empower consumers to make thoughtful choices about the foods they enjoy and the farming practices they support. Natural and artificial food colours vary in where they come from, their effects on health, and the rules that regulate them. Knowing these differences can help people make better choices about the foods they eat.

### Why Food Colours Are Important in Agriculture

The increasing dependency on food colours, whether natural or artificial, in agriculture and food production includes several key factors:

- 1. Consumer Expectation:** Consumers are naturally drawn to brightly coloured fruits, vegetables, and processed foods, associating them with freshness, ripeness, and quality. For instance, a deep red tomato or a golden-yellow mango often has a higher price than its less vibrant colour.
- 2. Uniform appearance in Food Markets:** Global food markets demand uniformity in the appearance of agricultural products. Retailers often reject produce that does not meet aesthetic standards, such as uneven colouration in apples or pale lettuce leaves. As a result, natural or artificial colour-enhancing practices, like the use of carotenoids or synthetic sprays, are employed to achieve consistency.
- 3. Food Processing and Value Addition:** When fruits and vegetables are turned into products like juices, sauces, or snacks, they can lose their natural colour. Food colours are added back in to make these items look fresh and appealing to customers.
- 4. Meeting Cultural and Regional Preferences:** In some cultures, certain food colours are more popular. For example, bright yellow rice or deeply coloured spices like turmeric are often seen as better quality. Farmers and food producers adjust their products to meet these preferences by using natural or artificial colouring.
- 5. Preserving Perception of Freshness:** Colours can also hide signs of aging or small flaws. For example, apples and citrus fruits might get wax coatings or dyes to keep them looking fresh longer during shipping and storage.

## Natural Food Colours in Agriculture

Natural food colours made from plants and crops are becoming more popular as people look for organic and "clean-label" products. Some common sources include:

✚ **Plant-Based Pigments:** Many fruits and vegetables have natural pigments that can be used in food. For example:

- Carrot provides beta-carotene (orange)
- spinach contains chlorophyll (green)
- Beets are rich in betalains (red and purple)

✚ **Edible Flowers:**

Flowers like marigolds, hibiscus etc., have bright colours. These are often used in sauces, sweets and tea.

✚ **Natural Food Dyes from Crops:**

Certain crops are grown for their natural colours like annatto seeds for a bright orange-red colour, and spirulina (a type of algae) for a blue-green colour and, turmeric for yellow.

## Benefits and challenges of natural food colours

✚ **Biodegradable:** They break down naturally in the environment and do not cause harm, unlike some artificial colours.

✚ **Non-toxic:** Natural food colours are safe to consume and do not contain harmful chemicals.

✚ **Renewable:** These colours come from plants and crops that can be grown again and again, making them a sustainable option.

However, there are also some challenges:

✚ **High Cost:** Producing natural food colours can be expensive because the crops need to be carefully grown and processed.

✚ **Inconsistent Colour:** The colour intensity can change depending on the growing conditions, such as the weather, soil quality, and time of harvest. This means that the colour might not always be the same.

✚ **Shorter Shelf Life:** Natural food colours may not last if artificial ones, meaning they might lose their colour faster, especially in processed foods.

Despite these challenges, natural food colours are still popular because they are safer and better for the environment.

## Artificial Food Colours in Agriculture and Food Production

Artificial food colours are man-made dyes created in labs, usually from petroleum-based chemicals. These colours are used in both agriculture and food production because they are stable, bright, and cheaper than natural colours. They have a long shelf life, making them perfect for mass-produced foods that are stored for a long time.

In agriculture, artificial food colours are used in two main ways:

✚ **Post-Harvest Treatments:** After crops are harvested, artificial colours can be applied to make fruits and vegetables look better. For example, fruits may be coated with a wax to make them shiny, or synthetic sprays can be used to enhance their colour, making them more appealing to consumers.

✚ **Processed Foods:** Many food products made from crops, like jams, juices, candies, and sauces, often contain artificial colours to make them look vibrant and attractive. Some of the most used artificial food colours include:

- **Red 40 (Allura Red):** A widely used red dye found in products like candy, soda, and snacks.
- **Yellow 5 (Tartrazine):** A yellow dye often found in soft drinks, snack foods, and sauces.
- **Blue 1 (Brilliant Blue):** A popular blue dye used in candies, drinks, and baked goods.
- **Green 3 (Fast Green):** A green colour used in candy, ice cream, and other processed foods.

## Benefits of Artificial Food Colours

- ✚ **Stable and Long-Lasting:** Artificial food colours stay bright and do not fade over time, making them perfect for processed foods that need to last a long time.
- ✚ **Cost-Effective:** They are cheaper to produce than natural colours, which makes food more affordable.
- ✚ **Vibrant Colours:** Artificial dyes can produce very bright, bold colours that are visually appealing to consumers.
- ✚ **Consistency:** They provide a consistent colour every time, regardless of factors like weather or growing conditions, unlike natural colours which can vary.

There are also some challenges of artificial food colours

- ✚ **Health Concerns:** Some studies suggest that certain artificial colours, like Red 40 and Yellow 5, might be linked to health problems such as hyperactivity in children, allergies, or even cancer, though more research is needed.
- ✚ **Environmental Impact:** Since artificial colours are made from petroleum-based chemicals, they can have a negative impact on the environment.
- ✚ **Banned or Restricted in Some Countries:** Due to health concerns, certain artificial food colours are banned or limited in some countries, making their use less universal.
- ✚ **Negative Consumer Perception:** Many people prefer natural products, and artificial colours can be seen as unhealthy or unnatural, leading some to avoid products that contain them.

Artificial food colours are useful for their stability, cost, and vibrant appearance, they come with health and environmental concerns that need to be addressed.

## Health and Environmental Implications of Natural vs. Artificial Food Colours

**Impact on health:** When it comes to health, natural food colours are usually seen as safer because they don't contain synthetic chemicals. However, they can still cause allergic reactions in some people, especially those who are sensitive to certain fruits or spices. For example, someone who is allergic to strawberries may also react to red food colours made from beets or berries. Artificial food colours, on the other hand, have raised more concerns. Even though organizations like the FDA and the European Food Safety Authority (EFSA) review the safety of food dyes, many artificial colours are still debated. Some studies suggest that artificial dyes can cause allergic reactions in children, leading to skin rashes, stomach problems, or even more serious effects like hyperactivity and attention issues.

**Environmental Impact:** Natural food colours can have both positive and negative effects on the environment. While growing crops for natural dyes supports biodiversity and organic farming, large-scale production of dyes like turmeric or annatto can use up a lot of water and take land away from growing food crops. Artificial food colours, made from petroleum-based chemicals, are not renewable and raise sustainability concerns. Although they are efficient to produce, they rely on non-renewable resources, which can harm the environment over time.

**The Bottom Line: Which is Better?** The choice between natural and artificial food colours depends on health, cost, and personal preferences. Natural colours are safer and better for the environment, but they are often more expensive and less stable. Artificial colours, on the other hand, are cheaper and longer-lasting, but may raise health concerns. To avoid artificial colours, focus on whole, unprocessed foods like fruits and vegetables, which naturally have vibrant, healthy colours. When consuming processed foods, it's important to check ingredient labels and make informed decisions based on your health needs and preferences. Ultimately, consumers should prioritize nutrition and make choices that support a healthier, more sustainable food system.