

THE USE OF ALLURA RED AC (RED DYE 40) IN THE FOOD INDUSTRY AND POTENTIAL HEALTH RISKS

Evelina GARABA

Department of Public Food Technology and Management, gr. TMAP– 221, Faculty of Food Technology, Technical University of Moldova, Chişinău, Republic of Moldova

*Corresponding author: liliana.prozor@lm.utm.md

Coordinator: Liliana PROZOR-BARBALAT, university assistant, Department of Foreign Languages, TUM

Summary. Allura Red AC or Red dye 40 is a synthetic red food colouring that is frequently used in the food industry to make food more visually appealing to consumers. In order to avoid excessive use of Red Dye 40, numerous countries have installed laws and regulations to control the allowed amounts of Allura Red in food and drinks, however, despite that, it represents a major health risk. Ingestion of Allura Red AC can lead to Hyperactivity, ADHD (Attention Deficit Hyperactivity Disorder), allergic reactions or DNA damage. The consumption of the dye should be avoided or kept to a minimum.

Keywords: Allura red AC, Red dye 40, food, consumption, health risk

Introduction

Red dye 40 is a synthetic red food colouring that is frequently used in the food business. It is also referred to as Allura Red AC (names most commonly used for the dye in the European Union), C.I. 16035 (the chemical name for the dye) or E129 (the E number assigned to the dye). Red dye 40 may occasionally be listed as part of a wider list of "artificial colours" or "added colours" ingredients rather than being stated as an ingredient on products that contain it. Allura Red AC is a vibrant red colour dye used to enhance the appearance of food and to make it more visually appealing to consumers.

Characteristics as a chemical compound

Allura Red AC is a synthetic food dye. The compound is soluble in water, glycerol and propylene glycol, ethanol, however, it is insoluble in oil. Some of the key characteristics of this chemical compound are:

1. Chemical formula: $C_{18}H_{14}N_2Na_2O_8S_2$.
2. Molecular weight: $496.4 \text{ g}\cdot\text{mol}^{-1}$.
3. Appearance: powder or granular solid with a bright red colour.
4. pH stability: It is stable in acidic conditions, but its colour fades in alkaline conditions.
5. Solubility: Allura Red AC is water-soluble but insoluble in organic solvents
6. Heat stability: It is relatively stable at high temperatures and can withstand industrial heat processing.
7. Toxicity: Allura Red AC is considered safe for consumption in small amounts, but excessive consumption can lead to serious health risks.
8. Chemical structure: fig. 1

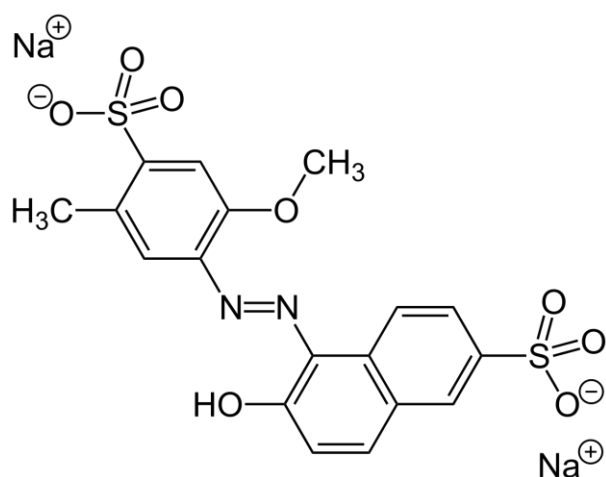


Figure 1. Chemical structure depiction of Allura Red AC

Uses of Allura Red AC

Red Dye 40 is one of the most popular colour dyes worldwide, it is most broadly utilised in the food industry as a colour additive.

Some of its specific uses include [1]:

1. Beverages: commonly used to give a red or pink colour to beverages such as soft drinks, fruit punches, and sports drinks.
2. Confectionery: used to colour various types of candy, including gummies, hard candies, and lollipops.
3. Baked goods: used to add colour to baked goods such as cakes, cupcakes, and cookies.
4. Desserts: used to colour desserts such as ice cream, puddings, and gelatine.
5. Sauces and dressings: used to add colour to sauces and dressings, such as ketchup and salad dressings.

The dye is also utilised in pharmaceuticals (as a colourant in tablets and capsules), cosmetics (as a colouring agent in cosmetics such as lipsticks, nail polish, and hair dyes), medical diagnostics (as a contrast agent to help visualise internal organs and tissues during certain medical procedures).

Acceptable daily intake

The amount of a substance that can be ingested daily over the course of a lifetime without posing a significant danger to health is known as the acceptable daily intake (ADI). The ADI is indicated as mg per kg of body weight. To avoid excessive use of Red Dye 40, numerous countries have installed laws and regulations to control the amounts allowed of Allura Red in food and drinks. The Joint FAO/WHO Expert Committee on Food Additives (JECFA) and the European Food Safety Authority (EFSA) have established an ADI of Allura Red of 0–7 mg per kg of BW (body weight) per day in food and beverage products [2].

According to EFSA each food class or a specific type of food has a permitted level of content of Allura Red AC.

As shown in Tab. 1, some product classes might contain very high levels of Allura Red AC, which could easily lead to consuming an excessive amount of the dye, coming over the limit of 7 mg per kg of BW per day. The main issue arising is the fact that almost no food companies indicate the content of Red Dye 40 on the label, neither in the ingredients list nor in the nutritional value table. As a consequence of previously said Red Dye 40 might present a serious health risk.

Table 1

Permitted level of Red dye 40 in foods [2]

Product class	Types of food	Permitted level (mg·L ⁻¹)
Soft drinks and other	Ready-to-drink cordial, vending machine concentrates, instant teas, bitter soda, bitter vino, liquid food, supplements/dietary, integrators	10-100
Alcoholic beverages	Beers, ciders, fortified and aromatised wines, spirituous beverages, aromatised wine-products cocktail, fruit wines	Up to 200
Confectionery	Boiled sweets, toffees, caramels, gums, jellies, pastilles, liquorice, chewing gum	50-300
Fine bakery	Biscuits, wafers, cakes, baking ingredients, preserves of red fruits, extruded or expanded savoury snack products	Up to 200
Soups	Complete formulae for weight control and nutritional supplements	Up to 50
Meat products	Breakfast sausage with a minimum cereal content of 6%, luncheon meat, burger meat	25
Meat and fish analogues	Based on vegetable proteins	Up to 100
Fish products	Surimi	500
Cheese	Edible cheese rind	No maximum level specified
Special dietary foods	Liquid food supplements	Up to 100
Deserts	Blancmanges, custards, mousses, dry mixes, sauces	Up to 150
Snack foods	Other savoury products and nuts	Up to 100
Sauces	Relishes, chutney, curry powder, tandoori	Up to 500

Safety concerns and health risks

There are certain safety issues and health dangers related to Allura Red AC, despite the fact that it is usually regarded as safe for consumption by regulatory authorities including the European Food Safety Authority (EFSA) and the U.S. Food and Drug Administration (FDA).

1. Hyperactivity and ADHD(Attention deficit hyperactivity disorder): Several studies [3,4] have suggested that Allura Red AC may worsen ADHD symptoms in young people by making them more hyperactive. The FDA mandates that warning labels notify consumers that goods containing Allura Red AC carry an announcement saying that the dye "may cause adverse effects on activity and attention in children."
2. Allergic reactions: Numerous people have reported adverse reactions after using Allura Red AC [2,5], reactions are especially bad for individuals who are sensitive to aspirin. Hives, facial or throat swelling, breathing problems, and, in more serious situations, anaphylaxis, can all be symptoms caused by the dye.
3. DNA damage: In some studies [6], Allura Red AC has been found to damage DNA, which can result in mutations and could raise the risk of cancer.

Conclusion

Allura Red AC is usually believed to be safe to use in minimal amounts, and not recommended to be consumed in larger amounts. Although most people can't see any immediate consequences there's evidence that over time the consumption of the dye leads to serious health issues. Even small amounts of Allura Red AC may represent a serious health hazard for some individuals, especially those with allergies or histamine intolerance. It's crucial to consume Allura Red AC in moderation and to be aware of any potential side effects, just like with any other dietary additive. The consumption of Red dye 40 should be completely avoided and manufacturers should replace it with natural dyes that don't endanger human lives.

References:

1. Joint FAO/WHO Expert Committee on Food Additives; WHO Food Additives Ser 15: Allura Red AC (1981). Available at: <https://apps.who.int/food-additives-contaminants-jecfa-database/Home/Chemical/2361>
2. John WILEY & Sons, Ltd “Scientific opinion on the re-evaluation of Allura Red AC (E 129) as a food additive” (2009) *EFSA Journal*, 7(11), p. 1327. Available at: <https://www.efsa.europa.eu/en/efsajournal/pub/1327>
3. McCANN, D., BARRETT, A., COOPER, A., CRUMPLER, D., DALEN, L., GRIMSHAW, K., STEVENSON, J. (2007). Food additives and hyperactive behaviour in 3-year-old and 8/9-year-old children in the community: a randomized, double-blinded, placebo-controlled trial. *The Lancet*, 370(9598), 1560-1567.
4. FDA. (2011). Summary of Color Additives for Use in the United States in Foods, Drugs, Cosmetics, and Medical Devices
5. SHARMA, A., KANWAR, R. K., & KANWAR, J. R. (2013). Allura red AC-induced allergic reaction. *Annals of Allergy, Asthma & Immunology*, 111(2), 148-149
6. BHATTACHARYA, S., YADAV, A., & TIWARI, R. K. (2017). Genotoxicity assessment of commonly used synthetic food colors on HepG2 cells. *Journal of Food Science and Technology*, 54(12), 3857-3866.