



Canadian Food
Inspection Agency

Agence canadienne
d'inspection des aliments

Food Colours in Selected Foods - April 1, 2020 to March 31, 2021

Food chemistry - Targeted surveys - Final report



Summary

Targeted surveys provide information on potential food hazards and enhance the Canadian Food Inspection Agency's (CFIA's) routine monitoring programs. These surveys provide evidence regarding the safety of the food supply, identify potential emerging hazards, and contribute new information and data to food categories where it may be limited or non-existent. They are often used by the agency to focus surveillance on potential areas of higher risk. Surveys can also help to identify trends and provide information about how industry complies with Canadian regulations.

Food colours are routinely added to foods and beverages for a variety of reasons, including to compensate for the loss of natural colour caused by processing conditions, and to meet consumer expectations by making the food more appealing and appetizing by enhancing the colour or making it more uniform. Targeted surveys focusing on colouring agents have been initiated in part due to potential health concerns associated with uses of non-permitted colouring agents in processed foods. The presence of non-permitted colouring agents may pose a health risk to the consumer, as some are potentially damaging to DNA and carcinogenic^{1,2}. Undeclared use of permitted synthetic colouring agents may also be a potential concern to a small percentage of the population which has exhibited sensitivity to synthetic colouring agents, resulting in skin rashes and triggering asthmatic reactions in individuals with asthma^{3,4}.

Targeted surveys focussed on food colours have been carried out previously. The primary focus of this survey was examination of brightly coloured products potentially containing added colors such as Allura Red and Amaranth. A total of 391 samples of bakery products, beverages, chips/crackers, dried mixes, frozen desserts, oils, sauces and sweets were collected and tested for up to 43 different food colours. Food colours were detected in 128 (33%) of the samples tested and 108 (28%) contained either Allura Red or/and Amaranth. When compared to previous survey years, this year's survey results show a comparable detection rate but a slightly lower compliance rate (95.1%). Food colours at levels exceeding the maximum level of use were detected in 9 samples, non-permitted food colours were found in 5 samples, and 5 samples contained permitted food colours/levels without a declaration of use in the list of ingredients.

All positive results obtained during the course of these surveys were forwarded to the CFIA's Office of Food Safety and Recall (OFSR). The extent of the follow up actions taken by the agency was based on the level of the contamination and the resulting health concern as determined by a health risk assessment. The levels of food colours observed in this survey were evaluated by Health Canada's Bureau of Chemical Safety who determined that none of the other samples tested would pose an unacceptable human health concern.

What are targeted surveys

Targeted surveys are used by the CFIA to focus its surveillance activities on areas of highest health risk. The information gained from these surveys provides support for the allocation and prioritization of the agency's activities to areas of greater concern. Originally started as a project under the Food Safety Action Plan (FSAP), targeted surveys have been embedded in our regular surveillance activities since 2013. Targeted surveys are a valuable tool for generating information on certain hazards in foods, identifying and characterizing new and emerging hazards, informing trend analysis, prompting and refining health risk assessments, highlighting potential contamination issues, as well as assessing and promoting compliance with Canadian regulations.

Food safety is a shared responsibility. We work with federal, provincial, territorial and municipal governments and provide regulatory oversight of the food industry to promote safe handling of foods throughout the food production chain. The food industry and retail sectors in Canada are responsible for the food they produce and sell, while individual consumers are responsible for the safe handling of the food they have in their possession.

Why did we conduct this survey

Arsenic is a naturally occurring element that can be found in the Earth's crust. Arsenic may be released into the air, water and/or soil through natural erosion/leaching or through man-made activities. The primary routes of human exposure to arsenic are through drinking water and food. The presence of arsenic in food is expected as a result of natural accumulation from the environment¹.

Arsenic can exist in both organic and inorganic forms in food; the inorganic forms are widely considered to be much more toxic to humans. The ratio of inorganic to organic arsenic species can vary widely depending on the source of contamination and the commodities in which it is present. While inorganic arsenic is the predominant species in drinking water, organic arsenic species are the main forms found in aquatic organisms (such as seaweed, fish, shellfish and crustaceans). Chronic exposure to inorganic arsenic may lead to a variety of detrimental health effects in humans, including affecting the gastrointestinal tract, kidneys, liver, lungs and skin as well as contributing to the risk of certain cancers^{2,3,4}.

The CFIA's regular monitoring activities examine the levels of total arsenic in various commodities but have not examined speciated arsenic to a great extent. As such, there is a need for surveillance data on the presence and levels of total arsenic as well as the various forms of arsenic, specifically levels of inorganic arsenic, in Canadian retail products.

What did we sample

A variety of domestic and imported bakery products, beverages, chips/crackers, dried mixes, frozen desserts, oils, sauces and sweets were sampled between April 1, 2020 and March 31, 2021. Samples of products were collected from local/regional retail locations located in 6 major cities across Canada. These cities encompassed 4 Canadian geographical areas:

- Atlantic (Halifax)
- Quebec (Montreal)
- Ontario (Toronto and Ottawa)
- West (Vancouver and Calgary)

The number of samples collected from these cities was in proportion to the relative population of the respective areas.

Table 1. Distribution of samples based on product type and origin

Product type	Number of domestic samples	Number of imported samples	Number of samples of unspecified ^a origin	Total number of samples
Bakery products	9	5	13	27
Beverages	16	4	39	59
Chips/Crackers	26	23	1	50
Dried mixes	1	21	12	34
Frozen desserts	27	3	34	64
Oils	0	48	0	48
Sauces	12	13	10	35
Sweets	13	45	16	74
Grand total	104	162	125	391

^a Unspecified refers to those samples for which the country of origin could not be assigned from the product label or available sample information

How were samples analyzed and assessed

Samples were analyzed by an ISO/IEC 17025 accredited food testing laboratory under contract with the Government of Canada. Based on the nature of the food product, samples were analyzed for water-soluble, oil-dispersible colours, or both. See Appendix A for a list of the colours analyzed. The results represent finished food products as sold and not as they would be consumed, whether the product sampled is considered an ingredient or requires preparation prior to consumption.

The results obtained from the analysis of the products were assessed against the regulations on permitted coloring agents established by Health Canada¹¹.

What were the survey results

Of the 391 food samples tested, artificial food colours were detected in 128 (33%) of the samples. Table 2 summarizes food colours detected and their prevalence in each product type. Bakery products had the highest percentage of samples containing 1 or more food colours at 78%, followed by dried mixes (65%). Food colours were detected in only 4% of chips/cracker samples tested. The highest levels of food colours were associated with baking mixes. Overall, 19 samples were non-compliant with Canadian food regulations. Food colours exceeding the maximum level of use were detected in 9 of these samples (4 different products). Non-permitted food colours were found in 4 palm oil samples (3 different products) and 1 hard candy sample; while, 5 samples contained permitted food colours/levels without a declaration of use in the list of ingredients.

As shown in Table 3, the most commonly detected food colours in the survey were Allura Red, Tartrazine, Brilliant Blue FCF, and Sunset Yellow FCF. These accounted for 74% of positive results. They were the most commonly detected colours in all survey years. Since the primary focus of this survey was examination of brightly coloured red/fuchsia products, the detection rates of colouring agents used to generate other food colours were usually lower than in previous survey years.

Table 2. Summary of food colour testing

Product type	Number of samples	Number of samples with food colours detected (%)	Number of times food colours were detected	Number of non-compliant samples (number of non-compliant results)
Bakery products	27	21 (78)	33	2 (2)
Beverages	59	28 (48)	34	1 (1)
Chips/Crackers	50	2 (4)	7	1 (1)
Dried mixes	34	21 (62)	23	7 (7)
Frozen desserts	64	12 (19)	35	0
Oils	48	4 (8)	9	4 (8)
Sauces	35	7 (20)	9	0
Sweets	74	33 (45)	71	4 (4)
Grand total	391	128 (33)	222	19 (23)

Table 3. Food colours detected and the number of samples in which the colour was detected

Colouring agent detected in survey samples (permitted colours in bold)	Number of samples in which colour was detected	Minimum (ppm)	Maximum (ppm)	Average ^b (ppm)
Allura Red	91	0.65	4500	176
Tartrazine	25	0.21	95.5	17.9
Brilliant Blue FCF	26	0.59	91.4	17.8
Sunset Yellow FCF	23	1.57	77.2	21.4
Erythrosin B	20	2.31	140	54.4
Amaranth	20	10.5	277	43.6
Indigo Carmine	4	5.60	30.5	21.9
Azurobine	1	31.5	31.5	31.5
Fast Garnet GBC	1	0.03	0.03	0.03
Fast Green FCF	3	0.85	8.10	3.37
Sudan IV	4	0.28	6.16	3.96
Sudan Red B	4	0.37	6.36	3.81

^b Only positive results were used to calculate the average food colour levels
ppm = parts per million

What do the survey results mean

The main objectives of this targeted survey were to expand upon baseline data regarding the levels of permitted synthetic food colours in selected foods on the Canadian retail market, and to obtain information regarding the presence of Allura Red and Amaranth in a variety of foods.

Out of a total of 391 samples tested, 372 (95.1%) samples were in compliance with Canadian standards and limits.

Table 4 compares this survey results with five years of past survey data for food colours.

When compared to previous survey years, this year's survey results show a slightly lower compliance rate due to the focus on different commodities^{12,13,14,15,16}. In general, the same types of non-compliant results found in the current survey were found in previous surveys in similar product types. The detection rates are in close agreement with the results of previous surveys when compared with similar commodities. It should be re-iterated that samples were selected due to their high likelihood of containing food colouring agents, and that prevalence in the food categories selected are not necessarily representative of the prevalence of synthetic food colours in all foodstuffs available at retail.

Table 4. Food colours results from various survey years

Survey year	Number of samples	Detection rate (%)	Compliance rate (%)	Number of non-compliant samples (number of non-compliant results)
2020	391	33	95.1	19 (23)
2019	398	0.5	99.7	1 (2)
2018	399	45	98.7	5 (5)
2014	980	15	98.9	11 (25)
2013	875	33	97.8	19 (22)
2012	1493	58	97.6	36 (38)

All positive results obtained during the course of these surveys were forwarded to the CFIA's OFSR. The extent of the follow up actions taken by the agency was based on the level of the contamination and the resulting health concern as determined by a health risk assessment. The levels of food colours observed in this survey were evaluated by Health Canada's Bureau of Chemical Safety who determined that none of the other samples tested would pose an unacceptable human health concern.

References

1. [Opinion of the Scientific Panel on Food Additives, Flavourings, Processing Aids and Materials in Contact with Food on a request from the Commission to Review the toxicology of a number of dyes illegally present in food in the EU.](#) (2005). European Food Safety Authority. EFSA Journal 263, pp. 1-71.
2. [Agents Classified by the IARC Monographs, Volumes 1-123.](#) (2019). International Agency for Research on Cancer.
3. Lockey, S.D. Sr. (1977). Hypersensitivity to tartrazine (FD&C Yellow No. 5) and other dyes and additives present in foods and pharmaceutical products. *Ann Allergy*. March 38 (3), pp. 206-210.
4. David, T.J. (1988). [Food Additives. Archives of Disease in Childhood.](#) 63, pp. 582-583
5. [Food Additives.](#) (2012). Canada. Health Canada.
6. [Lists of Permitted Food Additives.](#) (2017). Canada. Health Canada.
7. [Notice to Industry - Regulatory amendments related to nutrition labelling, list of ingredient and food colours.](#) (2018). Canada. Canadian Food Inspection Agency.
8. McCann, D., Barrett, A., Cooper, A., Crumpler, D., Dalen, L., Grimshaw, K., Kitchin, E., Lok, K., Porteous, L., Prince, E., Sonuga-Barke, E., Warner, J.O., Stevenson, J. (2007). [Food additives and hyperactive behaviour in 3-year-old and 8/9-year-old children in the community: a randomised, double-blinded, placebo-controlled trial.](#) *The Lancet*. Volume 370 (9598), pp.1560-1567.
9. [FAQ on food colours.](#) European Food Safety Authority.
10. [Media – Press Releases – Smarties now made with no artificial colours.](#) (2012). Nestlé Canada.
11. [Lists of Permitted Food Additives. 3. List of Permitted Colouring Agents \(Lists of Permitted Food Additives\).](#) (2017). Canada. Health Canada.
12. 2012-2013 Food Colours in Selected Foods. Canada. Canadian Food Inspection Agency. [unpublished data]
13. [2013-2014 Food Colours in Selected Foods.](#) (2019). Canada. Canadian Food Inspection Agency.
14. [2014-2015 Food Colours in Beverages, Condiments, Soups, Pickled Vegetables, Dried Spices and Mixes, and Oils.](#) (2019). Canada. Canadian Food Inspection Agency.
15. [2018-19 Food Colours in essences/flavourings, oils, sweets and processed vegetables.](#) (2021). Canada. Canadian Food Inspection Agency.
16. 2019-2020 Food Colours in Fish, Seafood, Meat and Meat Alternatives. Canada. Canadian Food Inspection Agency. [unpublished data]

Appendix A

List of colours tested by the accredited laboratory in this survey (permitted colours in bold)

Water-soluble colours	Tartrazine
	Amaranth
	Indigo Carmine (Indigotine)
	Sunset Yellow FCF
	Allura Red
	Ponceau SX
	Fast Green FCF
	Brilliant Blue FCF
	Erythrosin B
	Chlorophyllin
	Ponceau 4R (New Coccine) †
	Fast Red E †
	Bordeaux R †
	Erythrosin Yellowish (2,4,5- triiodofluorescein) †
	4,5-diiodofluorescein †
	Crocein Orange G †
	Orange II †
	2,4,7-triiodofluorescein †
	Orange GGN
	Azorubine (Carmoisine)
	Lissamine Green
	Quinoline Yellow 1
	Eosin Y
Patent Blue VF	
Patent Blue Violet Calcium	
Chrysoidine G	

	Rhodamine B
Fat-soluble colours	Sudan I
	Sudan II
	Sudan III
	Sudan IV
	Sudan Red B
	Sudan Red 7B
	Sudan Red G
	Sudan Orange G
	Sudan Blue II
	Solvent Blue 59
	Toluidine Red
	Para Red
	Methyl Yellow
	Metanil Yellow *
	Orange II *
	Rhodamine B *
	Sudan Black B
Citrus Red 2	

*May be present as a subsidiary food colour

*Water-soluble fat-soluble colours