



BOTANICAL  
MATERIAL HAZARD  
ASSESSMENT  
GUIDANCE v1.0

2023\_01

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## 1.0 Introduction

This guidance supports qualified ChemFORWARD Assessors in generating chemical hazard assessments (CHAs) of botanical materials, using test data and other information in the scientific literature.

The methodology is designed to account for the challenges in assessing botanical materials, which include:

- 1) They are complex mixture of ingredients;
- 2) It can be difficult to fully characterize their composition;
- 3) They are often data poor with respect to hazard information;
- 4) They are variable in nature.

These challenges make it hard to conduct complete chemical hazard assessments on botanical materials in a way that allows comparison to traditional chemicals for identification of safer alternatives.

**Generic botanical materials** will be characterized and assessed based on authoritative sources (see section 5) to produce chemical hazard assessments that aid in identification for safer alternatives.

**Trade name botanical materials** benefit from material-specific supplier information and will be evaluated in ChemFORWARD using the [ChemFORWARD SAFER Program guidance](#).<sup>1</sup> Trade name assessments account for the variability of different products.

## 2.0 Definitions

**Botanical Material:** a mixture, rather than a pure substance, derived from a specific plant part.

**Generic Botanical Material:** a botanical material defined by an INCI name, CAS #, or EC #, and that lacks specific information associated with sourcing, manufacturing and chemical characterization (i.e. constituents and residuals).

**Trade Name Botanical Material:** a botanical material produced by a supplier that is sourcing the material from a specific geographic region and using a defined part of the plant followed by a standardized manufacturing process resulting in reproducible constituent profiles including residual impurities.

**Constituent:** the individual component chemicals that make up the botanical material mixture,

identified by CAS# and concentration.

**Constituent of Concern:** A residual that is assigned a ChemFORWARD “F” hazard band regardless of its concentration. Residuals of high concern should be disclosed in the executive summary for the botanical materials by the Assessors. Residuals of high concern may be subject to specified limits by regulations or on restricted substances lists compiled by corporations, NGOs, or ecolabel/certification bodies such as Cradle to Cradle Certified.

**Constituent Analysis:** An approach to classifying a hazard endpoint for the botanical material as a whole by looking at the data available on the individual constituents. Using the Globally Harmonized System of Classification and Labeling of Chemicals (GHS) mixture rules, an Assessor can classify a hazard endpoint based on the classifications of the constituents.

**History of Safe Use:** An approach to considering significant human exposure to a food, drug, or cosmetic (over several generations and in a large, genetically diverse population) for which there exist adequate epidemiological or toxicological (including allergenicity) data to provide reasonable certainty that no harm will result from the exposure. (Definition adopted from “History of safe use as applied to the safety assessment of novel foods and foods derived from genetically modified organisms”.<sup>8</sup>)

### 3.0 Scope

Botanical materials may be assessed for the ChemFORWARD platform either as generic botanical materials, to aid in identification of safer alternatives, or as components of trade name botanical materials assessed via the ChemFORWARD SAFER program.

When a botanical material is identified generically, i.e., without the benefit of knowing the trade name manufacturer and detailed information on its constituents and residuals, it should be assessed as a generic botanical material and not as a trade name botanical material.

To assess a trade name botanical material, it is necessary to know the trade name and the manufacturer in order to obtain detailed information on the botanical material’s chemical composition, including:

- Species<sup>2</sup>
- Geography/origin<sup>2,3</sup>
- Production method<sup>2</sup>
- Part of plant<sup>3</sup>
- Processing and storage<sup>3</sup>

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## 4.0 Create the Botanical Material Chemical Hazard Assessment Entry

1. Create the CHA entry as you would for a conventional chemical.
2. Click Chemical Attributes in the left margin of the Chem*FORWARD* application and fill in the chemical attributes fields.
3. Fill out the relevant fields under the “Common” tab.
4. Select the “Botanical” tab.
5. Select “yes” in response to the question “is this substance a botanical material.”
6. Fill out the relevant fields illustrated in Figure 1 including the following botanical material attributes:
  - a. Enter required botanical material chemical identity information:
    - i. INCI Name
    - ii. CAS #
    - iii. EC#
  - b. Report genus / species / geography/origin and part of plant being assessed
  - c. Describe any relevant manufacturing or storage process assumptions (i.e. - aqueous extract)
  - d. Report any additional likely plant derived ingredient information
    - i. Report in chemical attributes section
    - ii. Identify common constituents / impurities by
      1. chemical name
      2. CAS number
      3. Concentration in botanical ingredient
  - e. Describe the scope of the assessment in the executive summary. A generic botanical material assessment takes into consideration typical characterization information including chemical attributes (e.g. boiling point). Constituents considered in the review and any identified constituents of concern (Section 5) should be included in the executive summary.

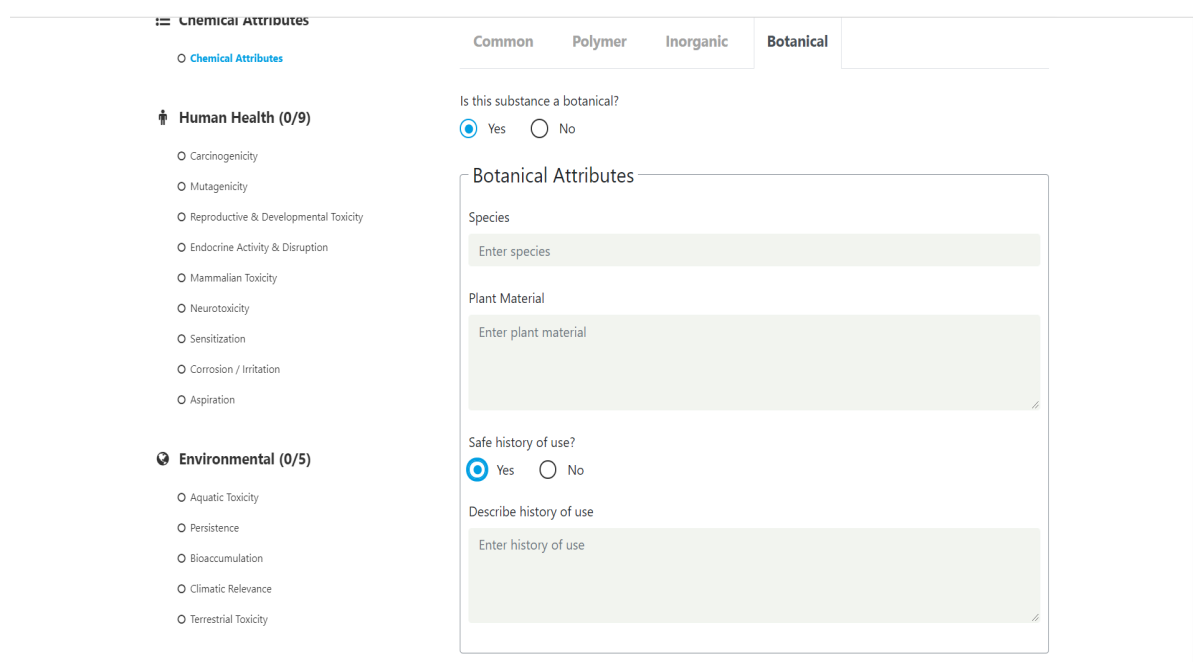


Figure 1. ChemFORWARD application interface for Assessor input of Botanical Material attributes

## 5.0 Fully Characterize the Botanical Material

Document all known constituents and list them in the Executive Summary based on:

- a) Available authoritative sources that describe typical constituents; or
- b) Trade name material characterization (disclosure) if working with a vendor

Describe the method of constituent identification and how the composition was identified (i.e. aqueous extraction).

Screen the constituents using the ChemFORWARD application (or via Pharos) to determine if they are constituents of concern based on their rating as LT-1 in Pharos or if they are otherwise assigned a ChemFORWARD “F” hazard band. Identify known constituents of concern in the Executive Summary.

After characterizing the botanical material, the Executive Summary should include: 1) likely plant derived ingredient information (genus/species; part of plant; source), 2) chemical characterization (constituents and constituents of concern), 3) typical manufacturing/extraction process, 4) impurities, and 5) history of safe use for the mixture or homogeneous material based on authoritative guidance from Food and Drug Administration (FDA), Health Canada, European Food Safety Authority (EFSA), and/or Association of SouthEast Asian nations (ASEAN).

The Assessor should take into account the extent of characterization when defining the confidence level for hazard classifications. For example if only 90% of the botanical material is characterized, the Assessor might choose to select low confidence when classifying certain hazard endpoints. The Assessor should use professional judgment to determine the level of characterization that determines their assignment of high or low confidence for the classification; this may vary depending on the material.

## 6.0 Prepare the Botanical Material Hazard Assessment

The Assessor will use the information on the botanical material and its constituents and enter the data summary, rationale, confidence selection, hazard classifications, etc. for each endpoint into the ChemFORWARD platform as described in the ChemFORWARD Assessor Guidance which is based on criteria from the Globally Harmonized System for the Classification and Labeling of Chemicals (GHS)<sup>4</sup> and the Cradle to Cradle Certified (C2CC) Material Health Assessment Methodology (MHAM).<sup>5</sup> Use the flowchart in Figure 2, to characterize the botanical material as follows:

- 1) Assess all available hazard information for the botanical material.
  - a) Look for empirical data for each endpoint for the botanical material. Does enough empirical data exist to assess the botanical material using the conventional C2CC Material Health Assessment Methodology<sup>5</sup> with a resulting hazard band of A, B, C or F? If no,
  - b) Review the literature to determine if there is sufficient evidence of history of safe use<sup>8</sup> for the botanical material for a specific exposure route and concentration level to classify any endpoints based on that history of safe use. Both the exposure concentration level and use application should be defined. (Note that any specified safe use limits will be needed for Step 2 of this section.)
  - c) Does the Assessor have enough endpoints classified, based on the ChemFORWARD Chemical Hazard Rating Guidance<sup>7</sup>, to score the botanical material so that it will not receive a “U” hazard band in ChemFORWARD? If no,
  - d) Does the botanical material contain any constituents of concern (assigned based on their GHS hazard classifications)? Is it in the botanical ingredient at a high enough concentration to warrant classification of the mixture for any endpoint? Can you classify more endpoints using this approach?
    - i) Conduct constituent analysis on endpoints with data gaps. To conduct constituent analysis, review GHS classification of identified constituents and using GHS mixture rules, determine if GHS classification is warranted for the endpoint.
    - ii) Prioritize those endpoints that are needed to assign a ChemFORWARD chemical hazard rating and to avoid a ChemFORWARD hazard band of “U”.
- 2) Due to the difficulty in fully characterizing botanical materials, the Assessors have a final

step of evaluating the uncertainty in the hazard assessment. If the botanical material has been classified using history of safe use, then a safe use limit that aligns with the exposure concentration used to classify the endpoint using history of safe use must be applied. There are other scenarios in which a safe use limit should be established and applied such when there is unknown composition, there are constituents of concern above GHS classification thresholds, or there are other factors that result in uncertainty in the assessment (similar to the example below):

- a) A safe use limit will be assigned and reported for botanical materials to ensure that any potentially hazardous constituents are below required regulatory safe use limits when the botanical material is used in a product formulation. Check the constituents against the Cradle to Cradle Restricted Substances List, and check for compliance with authoritative agency restrictions in beauty and personal care products (European Chemical Agency (ECHA) Cosmetic Products Regulation). For example:
  - i) Psoralens must be below 1 ppm in the final product formulation. Botanical materials containing psoralens at 5 ppm must not exceed 20% of the final product formulation.
- b) If the substance is poorly characterized, an Assessor may use professional judgment to say that classification is not possible for certain hazard endpoints or that a safe use limit should be assigned based on unknown compositions. For example:
  - i) If no history of safe use exists for a botanical material and only 90% of composition is known, the Assessor could assume that all of the unknown composition (10%) is hazardous. They would then calculate a safe use limit to ensure that the unknown concentration is below 100 ppm (the ChemFORWARD SAFER disclosure and reporting threshold). For this example, the final safe use limit would be 0.1% (dilute 100% by factor of 1000) so 10% of the unknown composition would be present at no more than 100 ppm in any final formulation.

## 7.0 Botanical Material Scoring

A single hazard rating for the botanical material will be generated by applying the ChemFORWARD chemical hazard rating guidance<sup>7</sup> to generate C2CC hazard ratings and ChemFORWARD hazard bands based on the results in the hazard summary table.

It is anticipated that some botanical materials will need to be scored in an iterative process (see Figure 2) to determine when the botanical material is sufficiently characterized to be given a final hazard rating.

To avoid botanical materials being assessed with a ChemFORWARD hazard band of “U” based on a lack of data, our approach prioritizes endpoints to classify to ensure limited gaps:

- At least 2 of 4 endpoints must be classified for Carcinogenicity, Mutagenicity, Reproductive/Developmental Toxicity, and Endocrine Disruption.
- At least 4 of the 6 Other Human Health endpoints must be classified
- At least one of Persistence, Bioaccumulation, or Aquatic Toxicity hazard endpoints must be classified

## 8.0 Overview

Figure 2 provides an overview of the process for preparing chemical hazard assessments for botanical materials using the ChemFORWARD application.

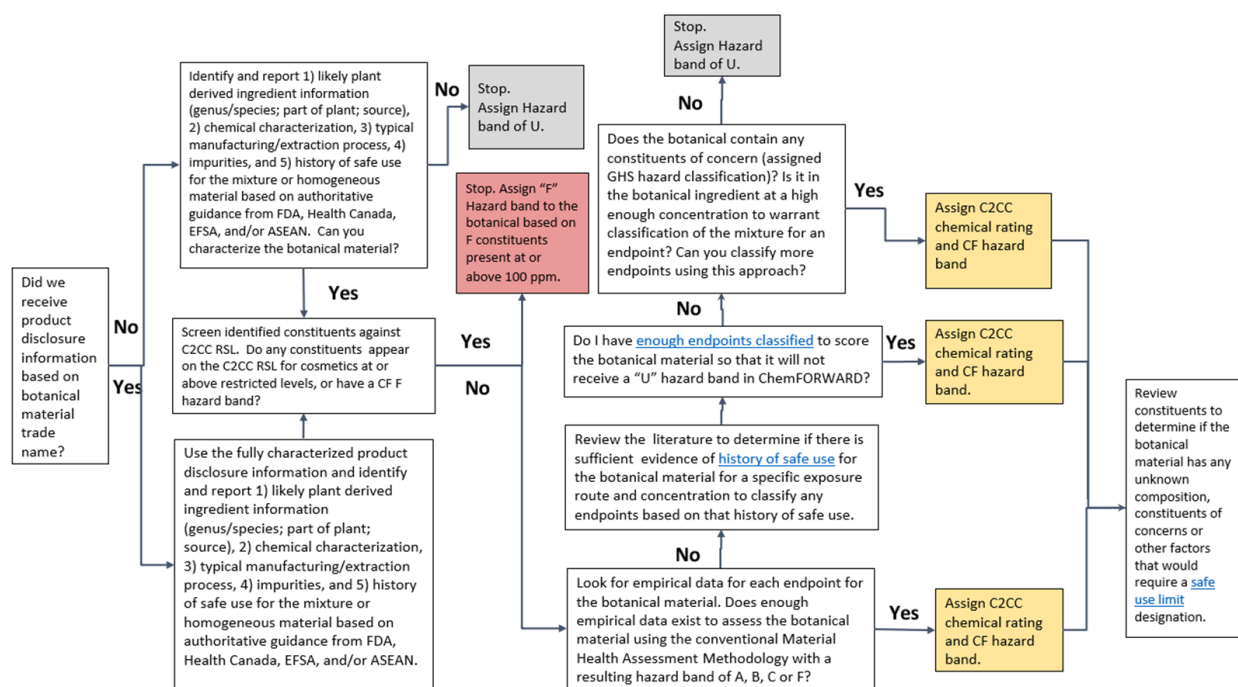


Figure 2. Overview of process for preparing a botanical material chemical hazard assessment



A standardized approach to assessing botanical materials that is comparable to how traditional chemicals are assessed is imperative to allow for the adoption of safer ingredients. With a lack of data available for many botanicals, the potential for regrettable substitution is high. The botanical material assessment method was designed to facilitate transparent and comprehensive chemical hazard assessments for botanical materials while accommodating the inherent variability of plant-derived ingredients.

## 9.0 References

1. [ChemFORWARD SAFER Program guidance](#)
2. [Decision tree for the safety assessment of botanical cosmetic ingredients](#). Personal Care Product Council Science and Support Committee. June 2012.
3. [Safety of botanical ingredients in personal care products/cosmetics](#). Food and Chemical Toxicology. 49 (2011), 324-341
4. [Globally Harmonized System of Classification and Labeling of Chemicals. Ninth revised edition](#).
5. [C2CC Material Health Assessment Methodology](#). February 2022.
6. [C2CC Restricted Substances List](#). March 2021.
7. [ChemFORWARD Chemical Hazard Rating Guidance](#)
8. History of safe use as applied to the safety assessment of novel foods and foods derived from genetically modified organisms.  
<https://www.sciencedirect.com/science/article/abs/pii/S0278691507002189>