EFFA Calculation Tool for the Proportional Reduction of Smoke Flavouring Primary Products

Preliminary remarks

The Commission Implementing Regulation (EU) No 1321/2013 *establishing the Union List of authorised smoke flavouring primary products for use as such in or on foods and/or for the production of derived smoke flavourings,* stipulates that there shall be a proportional reduction of the individual levels if a combination of (primary) smoke flavourings is used:

- *ANNEX Note 2: When combinations of smoke flavourings are used in or on foodstuffs, the* ***individual levels shall be reduced proportionally***

Customers are already asking for permissible use levels of compound flavourings containing primary smoke products and guidance is needed on how to calculate the **maximum permissible use levels** in given applications to ensure these are not exceeded.

EFFA has issued an **Information Letter** (IL13-22) with a tool / algorithm for the calculation of the '**proportional maximum use level**'.

The current guidance document explains the principles of the algorithm and shows some examples.

NOTE: The aim of this calculation is to ensure maximum levels are not exceeded.

'proportionality principle' on maximum use levels

- The level of each individual primary smoke product present in a combined flavouring must not exceed its individual maximum level in the food category as set by the Regulation.
- This individual maximum, when only one primary smoke product is used, represents 100% of its potential use (i.e. the total proportion equals 1).
- When several primary smoke products are used in combination in the same food, their use levels must be reduced proportionally so that the total of all proportions (of all individual maximum authorised use-levels) still equals 1.
- The following mathematical formula can be used to determine the maximum dosage for a combined flavouring that contains one or more primary smoke products.
- **This only works on the condition that the supplier provides the proportion of the primary product(s) in mixtures (i.e. percentage of primary products) they sell to the flavour companies/customers**

Mathematical formula

- ***md**:* is the maximum amount of the compound flavouring in the foodstuff of interest [g/kg].
- a_i : is the proportion of primary product SF-00i in the flavouring expressed in decimal value

  (e.g. if the flavouring contains 10% of SF-00i, then the proportion $a_i = 0.1$)
- b_i is the maximum authorised level of primary product SF-00i in the foodstuff of interest in [g/kg]
- ***n*** is the number of different primary smokes present in the compound flavouring.
- In other words, $$\frac{md.a_1}{b_1} + \frac{md.a_2}{b_2} + \cdots + \frac{md.a_n}{b_n} = 1$$
- Hence, ***md*** is defined as follows: $$\boldsymbol{md} = \frac{1}{\frac{a_1}{b_1} + \frac{a_2}{b_2} + \cdots + \frac{a_n}{b_n}}$$

Detailed explanation of the calculation

Taking the example 1 with one or two smoke primary products (see table below):

- SF001: 10% in the flavouring, individual maximum 1 g/kg in the food (used alone)
- SF009: 15% in the flavouring, individual maximum 0.06 g/kg in the food (used alone)

Proportionality principle = at the maximum dosage of the flavouring, the total of the % of the individual maximum of SF001 and of the % of the individual maximum of SF009 must be 100.

Objective: how to find the maximum dosage of the flavouring (100% of possible dose)

(all levels in g/kg)

- ✓ DM = maximum dosage of the flavouring
- ✓ A = final maximum level of SF001 in the food = DM x 0.1
- ✓ B = final maximum level of SF009 in the food = DM x 0.15

100% of the ratio of the two smokes is made of A/1 (part of the 100 % coming from SF001) + B/0.06 (part of the 100 % coming from SF009)

Hence:

- ⇨ DM x 0.1/1 + DM x 0.15/0.06 = 100/100
- ⇨ 0.1 x DM + 2.5 x DM = 2.6 x DM = 1
- ⇨ DM = 0.385 g/kg

Calculating back:

- ✓ For SF001: 0.385 g/kg of flavouring contains 0.0385 g SF001 = 3.85% of its individual maximum
- ✓ For SF009: 0.385 g/kg of flavouring contains 0.0577 g SF009 = 96.15% of its individual maximum
- ✓ 3.85% + 96.15% = 100% = objective

Example 1: Sauces (Cat. 12.6) with one or two smoke primary products

Objective: how to find the maximum permissible dosage of the flavouring (100% of possible dose)

Smoke primary product	Percentage of the smoke primary product in the compound flavouring	Proportion of the smoke primary product in the compound flavouring	Maximum permitted level of smoke primary product in food [g/kg]	Proportion of the primary product a_i divided by the maximum permitted level b_i	Add the ratios together to find the sum	Maximum dosage of compound flavouring = 1 divided by the sum of the ratios	Maximum amount of the compound flavouring in the foodstuff of interest [g/kg]
Calculation	$\%_i$	a_i	b_i	a_i / b_i	$\frac{a_1}{b_1}+\frac{a_2}{b_2}+\cdots+\frac{a_n}{b_n}$	$md=\frac{1}{\frac{a_1}{b_1}+\frac{a_2}{b_2}+\cdots+\frac{a_n}{b_n}}$	md
Example 1 – Sauces (Category 12.6): Flavouring containing *one* smoke primary product							
SF-001	10%	0.1	1.0	0.1	0.1	md = 1 / 0.1	**10**
SF-009	15%	0.15	0.06	2.5	2.5	md = 1 / 2.5	**0.4**
Example 1 – Sauces (Category 12.6): Flavouring containing *two* smoke primary products							
SF-001 **SF-009**	10% 15%	0.1 0.15	1.0 0.06	0.1 2.5	2.6	md = 1 / 2.6	**0.385**

100% of the ratio of the two smokes is made of the part of the 100 % coming from SF001 plus the part of the 100 % coming from SF009 i.e.

Working back	For SF001: 0.385 g/kg of flavouring contains 0.0385 g SF001 = *4% of its individual maximum* For SF009: 0.385 g/kg of flavouring contains 0.0577 g SF009 = *96% of its individual maximum*	} ***4% + 96% = 100% = Objective***

Example 2: Herbs, spices and seasonings (Cat. 12.2) with one, two or three smoke primary products

Smoke primary product	Percentage of the smoke primary product in the compound flavouring	Proportion of the smoke primary product in the compound flavouring	Maximum permitted level of smoke primary product in food [g/kg]	Proportion of the primary product a_i divided by the maximum permitted level b_i	Add the ratios together to find the sum	Maximum dosage of compound flavouring = 1 divided by the sum of the ratios	Maximum amount of the compound flavouring in the foodstuff of interest [g/kg]
SF-00i	$\%_i$	a_i	b_i	a_i / b_i	$\frac{a_1}{b_1} + \frac{a_2}{b_2} + \cdots + \frac{a_n}{b_n}$	$md = \frac{1}{\frac{a_1}{b_1} + \frac{a_2}{b_2} + \cdots + \frac{a_n}{b_n}}$	**md**
Example 2 – Herbs, spices and seasonings (Category 12.2): Flavouring with *one* smoke primary products							
SF-001	4.8%	0.048	2.3	0.021	0.021	md = 1 / 0.021	**47.6**
SF-004	8.4%	0.084	0.18	0.467	0.467	md = 1 / 0.467	**2.1**
SF-007	16.9%	0.169	1.0	0.169	0.169	md = 1 / 0.169	**5.9**
Example 2 – Herbs, spices and seasonings (Category 12.2): Flavouring with *two* smoke primary products							
SF-001 **SF-004**	4.8% 8.4%	0.048 0.084	2.3 0.18	0.02087 0.4666	0.4875	md = 1 / 0.4875	**2.051**
Working back	For SF001: 2.05 g/kg of flavouring contains 2.05 x 0.048 = 0.0984g SF001 For SF004: 2.05 g/kg of flavouring contains 2.05 x 0.084 = 0.1722g SF004				(0.0984/2.3) x 100 *4.3% of its individual maximum* (0.172/0.18) x 100 *95.7% of its individual maximum*		} $\sum = 100\%$
SF-001 **SF-007**	4.8% 16.9%	0.048 0.169	2.3 1.0	0.02087 0.169	0.1899	md = 1 / 0.1899	**5.266**
Working back	For SF001: 5.266 g/kg of flavouring contains 5.266 x 0.048 = 0.253g SF001 For SF007: 5.266 g/kg of flavouring contains 5.266 x 0.169 = 0.889g SF007				➔ (0.253/2.3) x 100 = *11.0% of its individual maximum* ➔ (0.889/1.0) x 100 = *89.0% of its individual maximum*		} $\sum = 100\%$

Smoke primary product	Percentage of the smoke primary product in the compound flavouring	Proportion of the smoke primary product in the compound flavouring	Maximum permitted level of smoke primary product in food [g/kg]	Proportion of the primary product a_i divided by the maximum permitted level b_i	Add the ratios together to find the sum	Maximum dosage of compound flavouring = 1 divided by the sum of the ratios	Maximum amount of the compound flavouring in the foodstuff of interest [g/kg]
SF-00i	$\%_i$	a_i	b_i	a_i / b_i	$\frac{a_1}{b_1} + \frac{a_2}{b_2} + \cdots + \frac{a_n}{b_n}$	$md = \frac{1}{\frac{a_1}{b_1} + \frac{a_2}{b_2} + \cdots + \frac{a_n}{b_n}}$	**md**
Example 2 – Herbs, spices and seasonings (Category 12.2): Flavouring with *two* smoke primary products (continued)							
SF-004 **SF-007**	8.4% 16.9%	0.084 0.169	0.18 1.0	0.467 0.169	0.636	md = 1 / 0.636	**1.572**
Working back	For SF004: 1.572 g/kg of flavouring contains 1 .572 x 0.084 = 0.132g SF004 For SF007: 1.572 g/kg of flavouring contains 1.572 x 0.169 = 0.266 g SF007				(0.132/0.18) x 100 = *73.4% of its individual maximum* (0.266/1.0) x 100 = *26.6% of its individual maximum*	} $\sum = 100\%$	
Example 2 – Herbs, spices and seasonings (Category 12.2): Flavouring with *three* smoke primary products							
SF-001 **SF-004** **SF-007**	4.8% 8.4% 16.9%	0.048 0.084 0.169	2.3 0.18 1.0	0.02087 0.467 0.169	0.6569	md = 1 / 0.6569	**1.522**
Working back	For SF001: 1.522 g/kg of flavouring contains 1.522 x 0.048 = 0.073g SF001 ➔ For SF004: 1.522 g/kg of flavouring contains 1.522 x 0.084 = 0.128g SF004 ➔ For SF007: 1.522 g/kg of flavouring contains 1.522 x 0.169 = 0.257g SF007 ➔				(0.073/2.3) x 100 = *3.2% of its individual maximum* (0.128/0.18) x 100 = *71.1% of its individual maximum* (0.257/1.0) x 100 = *25.7% of its individual maximum*	} $\sum = 100\%$	

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Enclosure: Excel table with additional worked out examples

[1] All flavourings - either produced from source materials qualified as food or as non-food - have to comply with the general food law (Regulation (EC) No 178/2002).

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