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European Union Reference Laboratory for Feed Additives

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EURL Evaluation Report on the Analytical Methods submitted in connection with the Application for the Authorisation of Feed Additives according to Regulation (EC) No 1831/2003

Dossier related to:	FAD-2010-0125 CRL/100097
Product Name:	Chemically defined flavourings from Chemical Group 08 – Secondary alicyclic saturated and unsaturated alcohols/ketones/ketals/esters with ketals containing alicyclic alcohols or ketones and esters containing secondary alicyclic alcohols
Active Substance(s):	Thirty two chemically defined flavourings from Chemical Group 08
Rapporteur Laboratory:	European Union Reference Laboratory for Feed Additives (EURL-FA)
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Report approved by: Date:	Christoph von Holst 21/02/2011

EXECUTIVE SUMMARY

The *Chemically Defined Flavourings - Group 08* (*Secondary alicyclic saturated and unsaturated alcohols/ketones/ketals/esters with ketals containing alicyclic alcohols or ketones and esters containing secondary alicyclic alcohols*), in this application comprises thirty two substances, for which authorisation as feed additives is sought under the category "sensory additives", functional group 2(b) "flavouring compounds", according to the classification system of Annex I of Regulation (EC) No 1831/2003.

In the current application submitted according to Article 4(1) and Article 10(2) of Regulation (EC) No 1831/2003, the authorisation for all species and categories is requested. The flavouring compounds of interest have a purity ranging from 90% to 99% and 85% for methyl 3-oxo-2-pentyl-1-cyclopentylacetate.

Mixtures of flavouring compounds are intended to be incorporated only into *feedingstuffs* or drinking *water*. The Applicant suggested no minimum or maximum levels for the different flavouring compounds in *feedingstuffs*.

For the identification of volatile chemically defined flavouring compounds *CDG08* in the *feed additive,* the Applicant submitted a qualitative multi-analyte gas-chromatography mass-spectrometry (GC-MS) method, using Retention Time Locking (RTL), which allows a close match of retention times on GC-MS. By making an adjustment to the inlet pressure, the retention times can be closely matched to those of a reference chromatogram. It is then possible to screen samples for the presence of target compounds using a mass spectral database of RTL spectra. The Applicant maintained two FLAVOR2 databases/libraries (for retention times and for MS spectra) containing data for more than 409 flavouring compounds. These libraries were provided to the EURL. The Applicant provided the typical chromatogram for the *CDG08* of interest.

In order to demonstrate the transferability of the proposed analytical method (relevant for the method verification), the Applicant prepared a model mixture of flavouring compounds on a solid carrier to be identified by two independent expert laboratories. This mixture contained twenty chemically defined flavourings belonging to twenty different chemical groups to represent the whole spectrum of compounds in use as feed flavourings with respect to their volatility and polarity. Both laboratories properly identified all the flavouring compounds in all the formulations. Since the substances of *CDG08* are within the volatility and polarity range of the model mixture tested, the Applicant concluded that the proposed analytical method is suitable to determine qualitatively the presence of the substances from *CDG08* in the *mixture of flavouring compounds.*

Based on the satisfactory experimental evidence provided, the EURL recommends for official control for the qualitative identification in the *feed additive* of the individual (or mixture of) *flavouring compounds* of interest (*) the GC-MS-RTL (Agilent specific) method submitted by the Applicant. However, the method is not able to discriminate between [menthol & D-menthol] or [beta-Damascone & tr-1-(2,6,6-Trimethyl-1-cyclohexen-1-yl)but-2-en-1-one] or the two isomers [d-Carvone & l-Carvone].

As no experimental data were provided by the Applicant for the identification of the *active substance(s)* in *feedingstuffs* and *water*, no methods could be evaluated. Therefore the EURL is unable to recommend a method for the official control to identify the *active substance(s)* of interest (*) in *feedingstuffs* or *water*.

Further testing or validation of the methods to be performed through the consortium of National Reference Laboratories as specified by Article 10 (Commission Regulation (EC) No 378/2005) is not considered necessary.

(*)Full list provided in EURL evaluation report, available from the EURL website.

KEYWORDS
Chemically Defined Flavourings - Group 08, mixture of flavouring compounds, sensory additives, all species.

1. BACKGROUND

The *Chemically Defined Flavourings - Group 08* (*CDG08*) is a grouped application for which authorisation as feed additive is sought under the category "sensory additives", functional group 2(b) "flavouring compounds" [1], according to the classification system of Annex I of Regulation (EC) No 1831/2003. The *CDG08* application contains thirty two flavouring compounds (listed in Table 1) belonging to the group - described in Annex I of Commission Regulation (EC) No 1565/2000 [2] as – " *Secondary alicyclic saturated and unsaturated alcohols/ketones/ketals/esters with ketals containing alicyclic alcohols or ketones and esters containing secondary alicyclic alcohols* ".

In the current application submitted according to Article 4(1) (new use in water) and Article 10(2) (re-evaluation of additives already authorised under Directive 70/524/EC) of Regulation (EC) No 1831/2003, the authorisation for all species and categories is requested [1].

The flavouring compounds of interest are produced by different routes of manufacturing, providing a purity ranging from 90% to 99% and 85% for methyl 3-oxo-2-pentyl-1-cyclopentylacetate [3]. *Mixtures of flavouring* compounds are usually prepared as liquid (diluted in an appropriate solvent, such as propane-1,2-diol) or solid (with an inorganic carrier, such as silicic acid + calcium carbonate) formulations.

Mixtures of flavouring compounds are intended to be incorporated only into *feedingstuffs* or drinking *water* [4]. The Applicant suggested no minimum or maximum levels for the different flavouring compounds [3], but normal contents of single flavouring compounds in *feedingstuffs* range up to from 0.1 to 100 mg/kg [4].

2. TERMS OF REFERENCE

In accordance with Article 5 of Regulation (EC) No 378/2005, as last amended by Regulation (EC) No 885/2009, on detailed rules for the implementation of Regulation (EC) No 1831/2003 of the European Parliament and of the Council as regards the duties and the tasks of the European Union Reference Laboratory concerning applications for authorisations of feed additives, the EURL is requested to submit a full evaluation report to the European Food Safety Authority for each application or group of applications. For this particular dossier, the methods of analysis submitted in connection with *Chemically Defined Flavourings – Group 08*, and their suitability to be used for official controls in the frame of the authorisation, were evaluated.

3. EVALUATION

Qualitative and quantitative composition of impurities in the additive

When required by EU legislation, analytical methods for official control of undesirable substances in the additive (e.g. arsenic, cadmium, lead, mercury, and dioxins) are available from the respective European Union Reference Laboratories [5].

Description of the analytical methods for the determination of the active substance in feed additive, premixtures and feedingstuffs

For the identification of volatile chemically defined flavouring compounds *CDG08* (cf. Table 1) in the *feed additive,* the Applicant submitted a qualitative multi-analyte gas-chromatography mass-spectrometry (GC-MS) [6] method, using Retention Time Locking (RTL) [7] methodology for which a patent is owned by Agilent Technology [8]. The Applicant does not mention about similar RTL systems from companies other than Agilent.

RTL allows a close match of retention times on Agilent GC-MS. By making an adjustment to the inlet pressure, the retention times can be closely matched to those of a reference chromatogram. It is then possible to screen samples for the presence of target compounds using a mass spectral database. The Applicant maintained two FLAVOR2 database/libraries (for the retention times and for MS spectra) containing data for more than 409 flavouring compounds (including those listed in Table 1) [8]. These libraries were provided to the EURL.

At first a GC-MS system suitability check is performed using an equal-weight mixture of Linalool, Acetophenone, Benzyl Acetate, Benzyl Alcohol, Hydroxycitronellal. The obtained characteristics of the chromatogram - related to quantitative compositions, peak shapes and elution order - should be comparable with those of the reference chromatogram [9].

Retention times of d-limonene are measured at five inlet pressures (normal; ±10%; ±20%) to construct the calibration curve "retention time" *vs.* "inlet pressure". The "nominal" inlet pressure is then interpolated using the Agilent GC-RTL software and the retention time of d-limonene of the "reference" chromatogram (8.3 or 6.7 min for non-polar or polar columns, respectively). This "nominal" inlet pressure is finally used when analysing the samples of interest with an Agilent GC-MS. The retention times of the peaks detected in the chromatograms are compared to those of the reference chromatogram to identify the various compounds detected, using the FLAVOR2 screener database. Further confirmation is performed using the FLAVOR2 mass spectral library [8].

Two sample preparation protocols are described. Solid samples of *mixture of flavouring compounds* are extracted with the Soxhlet or with the Accelerated Solvent Extractor (80%/20% hexane/acetone mixture). The extract is evaporated at vacuum to 50 mL. The solution is filtered on a 0.45 µm nylon filter and injected in the GC-MS [6] at constant "nominal" inlet pressure. Liquid samples of *mixture of flavouring compounds* are diluted (1:1) with acetone and injected in the GC-MS [6] at constant "nominal" inlet pressure. The Applicant provided the typical chromatogram for the *CDG08* of interest (cf. Fig II.2-5 [4]).

In order to demonstrate the transferability of the proposed analytical method (relevant for the method verification), the Applicant prepared a model mixture of flavouring compounds on a solid carrier (containing silicic acid and calcium carbonate) to be identified by two independent expert laboratories. This mixture contained twenty chemically defined flavourings belonging to twenty different chemical groups to represent the whole spectrum of compounds in use as feed flavourings with respect to their volatility and polarity. Both laboratories properly identified all the flavouring compounds in all the formulations [10, 11]. Since the substances of *CDG08* are within the volatility and polarity range of the model mixture tested, the Applicant concluded that the proposed analytical method is suitable to determine qualitatively the presence of most of the substances from *CDG08* in the *mixture of flavouring compounds.* However, the method is not able to discriminate between [menthol and D-menthol] and [beta-Damascone and tr-1-(2,6,6-Trimethyl-1-cyclohexen-1-yl)but-2-en-1-one] and the two isomers [d-Carvone and l-Carvone].

Based on the satisfactory experimental evidence provided, the EURL recommends for official control for the qualitative identification in the *feed additive* of the individual (or mixture of) *flavouring compounds* of interest (listed in Table 1) the GC-MS-RTL (Agilent specific) method submitted by the Applicant. However, the method is not able to discriminate between [menthol & D-menthol] or [beta-Damascone & tr-1-(2,6,6-Trimethyl-1-cyclohexen-1-yl)but-2-en-1-one] or the two isomers [d-Carvone & l-Carvone].

As no experimental data were provided by the Applicant for the identification of the *active substance(s)* in *feedingstuffs* and *water*, no methods could be evaluated. Therefore the EURL is unable to recommend a method for the official control to identify the *active substance(s)* of interest (cf. Table 1) in *feedingstuffs* or *water*.

Further testing or validation of the methods to be performed through the consortium of National Reference Laboratories as specified by Article 10 (Commission Regulation (EC) No 378/2005) is not considered necessary.

Table 1. Retention Time Locked for the flavouring compounds of *CDG08* [4], and d-limonene

FL-no	CAS-no	EU Register name	RTL polar (min)	RTL non-polar (min)
02.015	89-78-1	Menthol	18.48	12.30
02.218	1490-04-6	DL-Menthol (racemic)	18.48	12.30
02.016	507-70-0	Borneol	20.15	12.12
02.038	1632-73-1	Fenchyl alcohol	16.80	10.50
02.059	124-76-5	Isoborneol	18.95	11.85
07.007	127-41-3	alpha-Ionone	24.30	20.24
07.008	79-77-6	beta-Ionone	26.50	21.92
07.011	79-69-6	4-(2,5,6,6-Tetramethyl-2-cyclohexenyl)-3-buten-2-one	26.8-27.7	22.8-23.5
07.067	29606-79-9	Isopulegone	16.6-17.1	11.8-12.1
07.078	491-07-6	d,l-Isomenthone	14.40	11.90
07.083	23726-92-3	beta-Damascone	23.40	19.83
07.224	23726-91-2	tr-1-(2,6,6-Trimethyl-1-cyclohexen-1-yl)but-2-en-1-one	23.40	19.83
07.089	4674-50-4	Nootkatone	39.35	30.50
07.094	488-10-8	3-Methyl-2(pent-2-enyl)cyclopent-2-en-1-one	26.60	18.95
07.108	23696-85-7	beta-Damascenone	23.48	18.80
07.112	2758-18-1	3-Methyl-2-cyclopenten-1-one	15.40	5.80
07.126	78-59-1	3,5,5-Trimthylcyclohex-2-en-1-one	17.41	10.15
07.134	43052-87-5	alpha-Damascone	22.60	19.15
07.140	1128-08-1	3-Methyl-2-pentylcyclopent-2-en-1-one	24.47	18.60
07.146	2244-16-8	d-Carvone	21.37	14.25
07.147	6485-40-1	l-Carvone	21.37	14.25
07.159	4695-62-9	d-Fenchone	11.67	9.50
07.176	89-80-5	trans-Menthone	13.69	11.60
07.215	464-49-3	(1R)-1,7,7-Trimethylbicyclo[2.2.1]heptan-2-one	15.06	11.20
09.016	16409-45-3	Menthyl acetate	16.45	16.20
09.017	76-49-3	Bornyl acetate	16.90	15.95
09.027	622-45-7	Cyclohexyl acetate	10.30	8.10
09.215	97-42-7	Carvyl acetate	21.1-22.1	17.4-18.2
09.216	20777-49-5	Dihydrocarvyl acetate	19.370	17.24
09.218	125-12-2	Isobornyl acetate	17.10	15.95
09.269	13851-11-1	Fenchyl acetate	13.70	13.90
09.520	24851-98-7	Methyl 3-oxo-2-pentyl-1-cyclopentylacetate	34.50	26.40
01.045	5989-27-5	d-Limonene (standard)	6.70	8.33

FL-no: EU Flavour Number; RTL: Retention Time Locked; Co-eluting substances are highlighted

4. CONCLUSIONS AND RECOMMENDATIONS

The EURL recommends for official control the Agilent specific method submitted by the Applicant, for the identification of most of the thirty two *flavouring compounds* of the *CDG08* in the *feed additive* of the individual (or mixture of) *flavouring compounds* of interest. However, the method is not able to discriminate between [menthol & D-menthol] or [beta-Damascone & tr-1-(2,6,6-Trimethyl-1-cyclohexen-1-yl)but-2-en-1-one] or the two isomers [d-Carvone & l-Carvone].

The Applicant provided no experimental data for *feedingstuffs* and *water*, therefore the EURL is unable to recommend a method for the identification of the thirty two *flavouring compounds* of the *CDG08* in *feedingstuffs* and *water*.

Recommended text for the register entry (analytical method)

For the identification of thirty two *flavouring compounds* in mixtures of flavourings:

Gas-chromatography mass spectrometry with retention time locking (GC-MS-RTL)

5. DOCUMENTATION AND SAMPLES PROVIDED TO EURL

In accordance with the requirements of Regulation (EC) No 1831/2003, reference samples of *Chemically Defined Flavourings – Group 08* (*CDG08*) have been sent to the European Union Reference Laboratory for Feed Additives. The dossier has been made available to the EURL by EFSA.

6. REFERENCES

[1] *Application, Reference SANCO/D/2 Forw. Appl. 1831/0090-2010

[2] Commission Regulation (EC) No 1565/2000 laying down the measures necessary for the adoption of an evaluation programme in application of Regulation (EC) No 2232/96 of the European Parliament and of the Council

[3] *Application, Proposal for Register Entry – Annex A

[4] *Technical dossier, Section II – Sect_II_Identity.pdf: 2.1. Identity of the additives - 2.5. Conditions of use of the additive – 2.6. Method of analysis and reference samples

[5] Commission Regulation (EC) No 776/2006 amending Annex VII to Regulation (EC) No 882/2004 of the European Parliament and of the Council as regards to Community Reference Laboratories

[6] *Technical dossier, Section II – Annex_II_05_FFAC 2008 GCMS method.pdf "GC/MS method for the identification and assay of feed flavourings"

[7] *Technical dossier, Section II – Annex_II_07_RTL Lock.pdf

[8] *Technical dossier, Section II – Annex_II_06_Flavour RTL.pdf

[9] *Technical dossier, Section II – Annex_II_04_Methods assay.pdf

[10] #Supplementary Information – Analytical report Pancosma.pdf

[11] #Supplementary Information – Analytical report Phytosynthese.pdf

* Refers to Dossier No. FAD-2010-0125

Refers to Dossier No. FAD-2009-0050

7. RAPPORTEUR LABORATORY & NATIONAL REFERENCE LABORATORIES

The Rapporteur Laboratory for this evaluation was European Union Reference Laboratory for Feed Additives, IRMM, Geel, Belgium. This report is in accordance with the opinion of the consortium of National Reference Laboratories as referred to in Article 6(2) of Commission Regulation (EC) No 378/2005, as last amended by Regulation (EC) No 885/2009.

8. ACKNOWLEDGEMENTS

The following National Reference Laboratories contributed to this report:

- Landwirtschaftliche Untersuchungs- und Forschungsanstalt (LUFA) Speyer, Speyer (DE)
- Centro di referenza nazionale per la sorveglianza ed il controllo degli alimenti per gli animali (CReAA), Torino (IT)
- Österreichische Agentur für Gesundheit und Ernährungssicherheit (AGES), Wien (AT)
- Ústřední kontrolní a zkušební ústav zemědělský (ÚKZÚZ), Praha (CZ)
- Instytut Zootechniki w Krakowie, Krajowe Laboratorium Pasz, Lublin (PL)
- Laboratoire de Rennes, SCL L35, Service Commun des Laboratoires, Rennes (FR)