

Product group: Biopharma

Brand name: BioHale® Trehalose

Dihydrate

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Questionnaire for Excipient Nitrosamines Risk Evaluation

Several authorities issued guidance and information on nitrosamine impurities and request Marketing Authorization Holders (MAHs) to conduct a risk evaluation with regards to nitrosamine formation in their drug products. Excipients can contribute to the formation or content of nitrosamines in drug products either directly or through precursor substances present in the excipient (e.g., nitrites, nitrates, amines, or other nitrogen containing compounds). This questionnaire aims to provide information about excipients to assist the MAH in their evaluation of the risk of the presence of nitrosamine impurities in the final drug product.

In December 2019 IPEC Europe published a questionnaire assisting excipient manufacturers to collect data that MAH would need to perform their nitrosamine risk assessment. This questionnaire has been used successfully and the information collected herewith was well received by MAHs.

This questionnaire is revised to reflect the 2020 regulatory updates, with reference to the EMA assessment report "Nitrosamine impurities in human medicinal products", the related EMA guidance including the "Questions and answers for marketing authorization holders", the US FDA Guidance for Industry "Control of Nitrosamine Impurities in Human Drugs"⁴ and how they may be adapted for pharmaceutical excipients. However, the information generated should also assist companies to address similar requests from other regulatory authorities, based on our current understanding of global activities on this subject.

The questionnaire includes a matrix to consider the structure and the origin of the excipient as first risk indication. In addition, excipient suppliers are encouraged to share their conclusion.

The use of a standard format will facilitate data collection from excipient suppliers and thus enable a more efficient process of conducting the required risk assessments by drug product manufacturers / Marketing Authorisation Holders.

With this form, excipient suppliers can provide information for nitrosamine risk evaluation to the best of their knowledge, considering available supplier information and likely chemical production processes where information from the supplier is not available.

This information for nitrosamine risk evaluation is prepared for:

Supplier product number and	BioHale® Trehalose Dihydrate
name:	

¹ European Medicines Agency (EMA): Assessment report, procedure under Article 5(3) of Regulation EC (No) 726/2004, Nitrosamine impurities in human medicinal products. EMA 369136/2020, 25 June 2020, https://www.ema.europa.eu/en/documents/referral/nitrosamines-emea-h-a53-1490-assessment-report_en.pdf

² European Medicines Agency (EMA): Nitrosamine impurities, Guidance for marketing authorization holders. https://www.ema.europa.eu/en/human-regulatory/post-authorisation/referral-procedures/nitrosamine-impurities#guidance-for-marketing-authorisation-holders-section.

³ European Medicines Agency (EMA): Questions and answers for marketing authorization holders/applicants on the CHMP Opinion for the Article 5(3) of Regulation (EC) No 726/2004 referral on nitrosamine impurities in human products. EMA/409815/2020 Rev.1, 29 January 2021. https://www.ema.europa.eu/en/documents/referral/nitrosamines-emea-h-a53-1490-questions-answers-marketing-authorisation-holders/applicants-chmp-opinion-article-53-regulation-ec-no-726/2004-referral-nitrosamine-impurities-human-medicinal-products_en.pdf

⁴ U.S. Food & Drug Administration, Control of Nitrosamine Impurities in Human Drugs, Revision 1, February 2021, https://www.fda.gov/media/141720/download



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Supplier:	DFE Pharma GmbH & Co. I	(G		
1) Please tick the applicable cated the risk of formation of nitrosami		origin of the ex	cipient in supp	port to evaluate
ves produ	Proteins, enzymes, ucts of fermentation or tion of biologic sources,		hetic origin gen contair	
Target E Nitrogen of	Mined excipients, N-roducts of fermentation ratural origin,	bases polyme	ee mineral a , organic so ers, inorgan ganic N-free 	lvents, ic salts,
	No		Yes	
	Chemical Synthetic Moduling processes to introduction to biological productions.	oduce chemic	ally synthe	sized
2) Is sodium nitrite (NaNO ₂) or an nitrosating agent ⁶ :	ny other nitrite or			Information not available
 used in any steps in the r reagents/catalyst? 	manufacturing process ⁷ as	YES □	NO ⊠	not available
 known to be used in the materials or intermediate manufacturing process? 		YES 🗆	NO 🗵	
 known to be used in the reagents/catalysts/proce 		YES □	NO ⊠	

⁵ Nitrogen-free materials are considered to be of lower inherent risk for nitrosamine contamination as they are typically manufactured without and do not contain nitrosatable structures. Nitrosamines have been observed in medicinal products with N-containing APIs of chemical synthetic origin. EMA concludes that there is a very low risk of nitrosamines being present as impurities in biological medicinal products, although it can't be completely ruled out. Error! Bookmark not defined.

⁶ see Guidance 1 in Annex

 $^{^{7}}$ in this document, "manufacturing process" refers to the manufacturing steps that are outlined in the flow chart of the manufacturing procedure for the mentioned excipient.



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	I .	I	
manufacturing process?			
 known or likely to be generated during the manufacturing process? 	YES 🗆	NO ⊠	
 deliberately added to the process, including components of cell culture media or for fermentation? 	YES 🗆	NO ⊠	
3) Have you analysed, and are the results available for the excipient for:			Test result, if available
- Nitrites?	YES □	NO ⊠	ii available
- Nitrates?	YES □	NO ⊠	
- Nitrosamines?	YES ⊠	NO □	
If yes, please provide test results for the tested analyte and a general indication of the applied test method and indicate if testing was performed in-house or contracted out. Analytical data for nitrosamines were collected to confirm findings of a Risk Assessment performed by DFE Pharma. Data obtained are used to validate our risk assessment (may be consulted on DFE Pharma sites) and are mentioned there. All data obtained for nitrosamines are below 2 ppb (<limit detection).<="" of="" td=""><td></td><td></td><td></td></limit>			
4) Where water is used in the manufacturing process ⁷ , is it prepared by distillation, by ion exchange or by reverse osmosis?	YES ⊠	NO □	Not applicable □
If "No", please inform about the maximum level of - Nitrites - Nitrates	ppm	Not specified	
5) Is there any secondary and/or tertiary amine ⁸ present in the manufacturing process as ⁷ : - Raw material ⁹ ? - Intermediate? - Reagent? - Processing aids?	YES YES YES YES YES	NO ⊠ NO ⊠ NO ⊠ NO ⊠	

⁸ see Guidance 2 in Annex

 $^{^9\,2020\,\,} IPEC\,\, General\,\, Glossary\,\, of\,\, Terms\,\, and\,\, Acronyms,\,\, \underline{https://www.ipec-europe.org/glossary.html}$



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- Catalyst / Base?	YES □	NO ⊠	
- Solvent?	YES □	NO ⊠	
If yes, are those amines present in the			Not applicable
- Same	YES □	NO □	
- Previous			
- Subsequent	YES 🗆	NO 🗆	
step as any nitrosating agent mentioned in section 2?	YES □	NO □	
step as any microsating agent mentioned in section 2.			
Information about the chemical name / structure of amine(s):			
Not applicable			
6) Is there any amide, primary amine or ammonium salt used or			
present in the excipient manufacturing process as:			
present in the exciplent manufacturing process as:			
Davumantavial	VEC [NO M	
- Raw material	YES □	NO ⊠	
- Intermediate	YES □	NO 🗵	
- Reagent	YES □	NO ⊠	
- Processing aid	YES □	NO ⊠	
- Catalyst / Base	YES □	NO ⊠	
- Solvent	YES 🗆	NO ⊠	
- Washing Fluid	_	NO ⊠	
	YES 🗆		
Information about the chemical name / structure:			
Not applicable			
7) Recycled/recovered Solvents ¹⁰ :			
- Are recycled / recovered nitrogen containing solvents	YES □	NO ⊠	
used in the manufacturing process?			
8) Multipurpose Equipment:			Not applicable
- Is the excipient produced in multipurpose equipment?	YES ⊠	NO □	
- In case of multipurpose equipment, is the equipment			
used for manufacturing of any material involving	YES □	NO ⊠	
nitrites, nitrosating agents or material with identified			
risk of formation of nitrosamines?			
9) Conclusion			
The probability that nitrosamines are present in the reference	ed products is	very low	
•	-	•	

¹⁰ see Guidance 3 in Annex



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Annex11:

Guidance 1 (Sources of nitrosating agents)

Nitrosating agents to be considered include: nitrites (e.g. sodium nitrite, NaNO₂) and nitrous acid (HNO₂), nitric oxide (NO), nitrosyl halides (e.g. ClNO, BrNO), dinitrogen trioxide (N₂O₃), dinitrogen tetroxide (N₂O₄) and organic nitrites (e.g. t-BuONO).

Other potential nitrosation risks:

- Side reaction in nitration reactions. Nitric acid typically contains nitric oxide as an impurity, additional nitrous acid may also be produced, leading to nitrosation, if any reducing agents are present.
- Hydroxylamine under oxidative conditions.
- Chloramines are known to generate N-nitrosamines under certain conditions and so should also be considered.¹²
- Ozone may lead to the formation of N-nitrosamines by initial oxidation of amines to nitrite.
- Use of azide salts and azide compounds is commonly followed by quenching with nitrous acid or nitrites and may lead to nitrite residues. 12
- Nitric acid and nitrates under reducing conditions may result in by-products with nitrosating activity.¹³

This evaluation must include the use of all chemicals within a process, including those used during the quench and work-up as well as during reactive chemistry.

Guidance 2 (Sources of secondary and tertiary amines)¹³

Secondary amines are of greatest concern, however tertiary amines can also undergo nitrosation via more complex pathways. All secondary and tertiary aliphatic and aromatic amines should therefore be considered including those present as part of the starting material, intermediate or final structure as well as those introduced as reagents, catalysts, solvents or as impurities.

Tertiary amine bases (i.e. triethylamine, diisopropylethylamine and N-methylmorpholine) are known to degrade to secondary amines and have been implicated in N-nitrosamine formation.

Amines may also be introduced as impurities or degradants:

- Of common amide containing solvents such as N,N-dimethylformamide (DMF), N,N-dimethylacetamide (DMAC) and N-methylpyrrolidinone (NMP)
- Of quaternary ammonium salts such as tetrabutylammonium bromide (TBAB)

 $^{^{11}}$ This information is partly transferred from the EFPIA decision tree for drug substances, published 1 Nov 2019

¹² Nawrocki, J et al. Nitrosamines and Water, J. Hazard. Mater. 2011, 189, 1-18.

¹³ SCCS (Scientific Committee on Consumer Safety), Opinion on Nitrosamines and Secondary Amines in Cosmetic Products, 27 March 2012.



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Of primary amines such as monoethylamine

Of starting materials, intermediates, or the product itself

This evaluation must include the use of all chemicals within a process, including those used during the quench and work-up as well as during reactive chemistry.

Guidance 3 (Potential contamination risks)

Consider all potential sources of contamination in input materials.

Use of recovered materials (solvents, reagents, catalysts) is of particular concern if appropriate controls are not put in place. The materials DMF, ortho-xylene and tributyltin chloride were highlighted by the EMA as materials at risk of cross contamination by N-nitrosamines. Sodium azide was highlighted by Health Canada for risk of cross contamination with nitrite.

Cross contamination from other processes using shared equipment should be considered. Steps performed under GMP (using solvents/reagents with appropriate controls, and controls on their recovery and reuse) are considered to be a lower cross contamination risk.