Biocidal Products Committee (BPC)

Opinion on the application for approval of the active substance:

Ozone generated from oxygen

Product type: 4

ECHA/BPC/304/2021

Adopted

1 December 2021

Opinion of the Biocidal Products Committee

on the application for approval of the active substance ozone generated from oxygen for product type 4

In accordance with Article 8(4) in combination with Article 93 of Regulation (EU) No 528/2012 of the European Parliament and of the Council 22 May 2012 concerning the making available on the market and use of biocidal products (BPR), the Biocidal Products Committee (BPC) has adopted this opinion on the approval in product type 4 of the following active substance:

Common name:	**Ozone generated from oxygen**
Chemical name:	**Ozone**
EC No.:	**Not applicable for an *in situ* generated active substance**
CAS No.:	**Not applicable for an *in situ* generated active substance**

New active substance submitted under Article 8(4) in combination with Article 93 of the BPR

This document presents the opinion adopted by the BPC, having regard to the conclusions of the evaluating Competent Authority. The assessment report, as a supporting document to the opinion, contains the detailed grounds for the opinion.

Process for the adoption of the BPC opinion

Following the submission of an application by EurO3zon on 5 June 2015 the evaluating Competent Authority Germany submitted an assessment report and the conclusions of its evaluation to the ECHA on 9 September 2020. Another application for the same active substance is evaluated by the Competent Authority of the Netherlands. The evaluation of this application has not yet been finalized and is not reflected in this opinion. In order to review the assessment report and the conclusions of the evaluating Competent Authority, the Agency organised consultations via BPC (BPC-41) and its Working Groups (WG III 2021). Revisions agreed upon were presented and the assessment report and the conclusions were amended accordingly.

Adoption of the BPC opinion

Rapporteur: Germany

The BPC opinion on the application for approval of the active substance ozone generated from oxygen in product type 4 was adopted on 1 December 2021.

The BPC opinion was adopted by consensus.

The opinion is published on the ECHA webpage at: http://echa.europa.eu/regulations/biocidal-products-regulation/approval-of-active-substances/bpc-opinions-on-active-substance-approval.

Detailed BPC opinion and background

1. Overall conclusion

The overall conclusion of the BPC is that ozone generated from oxygen in product type 4 may be approved. The detailed grounds for the overall conclusion are described in the assessment report.

2. BPC Opinion

2.1. BPC Conclusions of the evaluation

a) Presentation of the active substance including the classification and labelling of the active substance

This evaluation covers the use of ozone generated from oxygen in product type 4.

Ozone is generated from ambient air, water or oxygen *in situ* using a device, but in all cases, oxygen is the relevant component. Information about the ozone generation process (e.g. amount of ozone, residual amount of precursor) is available and a specification for the precursor oxygen is established.

The generated active substance ozone is a colourless to pale blue gas with oxidising properties. Physico-chemical properties have been evaluated for the generated active substance Ozone and the precursor oxygen and are deemed acceptable. No product data has been submitted, as the only precursor which could be placed on the market with a biocidal claim might be liquid oxygen[1]. In the other cases, i.e. when ozone is generated from ambient air, water or oxygen not supplied with the intention to generate ozone (e.g. generic oxygen canisters), the generated active substance is the biocidal product[2].

Acceptable analytical methods are available for the active substance ozone generated in water or air.

Validated residue analytical methods are available for the active substance ozone in drinking and surface water and in air. Residue analytical methods for the active substance in soil, body fluids and tissues as well as in food and feeding stuff are not required for the intended use.

Validated residue analytical methods are available for the determination of bromate and bromoform in drinking water. According to Commission Directive 2003/40/EC[3] maximum limits of bromate and bromoform should be monitored after treatment of natural mineral waters by ozone-enriched air. Validated residue analytical methods are available for the determination of bromate and trihalomethane (sum of chloroform, bromoform, dibromochloromethane, bromodichloromethane) in drinking water. According to Commission Directive 2020/2184[4], the maximum limit of bromate and trihalomethane should be monitored in drinking water. Validated residue analytical methods are available for the determination of chlorate and chlorite in drinking water. According to the WHO Guidelines

[1] The placing on the market of oxygen with a biocidal claim would not fall under the transitional measures specified in Article 93 of the BPR

[2] CA-May15-Doc.5.1.a – Final "Management of in situ generated active substances in the context of the BPR - The case of ozone": https://circabc.europa.eu/ui/group/e947a950-8032-4df9-a3f0-f61eefd3d81b/library/acdcf5ce-4113-4b85-abef-5ec2e1af5a5f/details

[3] Commission Directive 2003/40/EC of 16 May 2003 establishing the list, concentration limits and labelling requirements for the constituents of natural mineral waters and the conditions for using ozone-enriched air for the treatment of natural mineral waters and spring waters (OJ L 126, 22.5.2003, p. 34–39).

for drinking-water quality, 4th edition (2011) the maximum limit of chlorate and chlorite should be monitored in drinking water.

A harmonised classification is not availbale for ozone. A CLH dossier was submitted to ECHA on 24 July 2020.The proposed classification and labelling for ozone according to Regulation (EC) No 1272/2008 (CLP Regulation) is:

Proposed Classification according to the CLP Regulation[5]	
Hazard Class and Category Codes	Ox. Gas 1, H270 Acute Tox. 1, H330 STOT SE 1, H370 STOT SE3, H335 STOT RE1, H372 Muta. 2, H341 Carc. 2, H351 Aquatic acute 1, H400 Aquatic chronic 1, H410
Labelling	
Pictogram codes	GHS03, GHS06, GHS07, GHS08, GHS09
Signal Word	Danger
Hazard Statement Codes	H270: May cause or intensify fire: oxidizer H330: Fatal if inhaled H370: Causes damage to organs (nervous system) H335: May cause respiratory irritation H372: Causes damage to organs through prolonged or repeated exposure (cardiovascular, nervous, respiratory system) H341: Suspected of causing genetic defects H351: Suspected of causing cancer H410: Very toxic to aquatic life with long lasting effects
Specific Concentration limits, M-Factors	M = 100 for acute toxicity to aquatic life M = 1 for chronic toxicity to aquatic life
Justification for the proposal	
-	

b) Intended use, target species and effectiveness

For ozone generated from oxygen in PT4, the intended and evaluated use is disinfection of bottles in the beverage industry before filling. Ozone is generated *in-situ* by an ozone generator using three key methods. For water treatment ozone is typically generated from ambient air or oxygen using the DBD method (dielectric barrier discharge). Other methods used are the generation from ambient air by UV light and the electrolytic generation from water. The *in-situ* generation of ozone takes place in a closed device.

Ozone is a strong and unspecific oxidant inactivating microorganisms by oxidising crucial components of cells and cell membranes.

The active substance, which is identical to the representative biocidal product, demonstrated sufficient innate yeasticidal activity within approximately 15 seconds under simulated use conditions at a concentration of 1 mg/L in aqueous solution.

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[4] Directive (EU) 2020/2184 of the European Parliament and the Council of 16 December 2020 on the quality of water intended for human consumption

[5] The NL CA being the eCA of the second application for "ozone generated from oxygen" comes to a different conclusion in relation to skin and eye irritation/corrosion. Based on the same data, the NL CA proposes to classify ozone as Skin Irrit., H315 and Eye Irrit., H319.

As ozone is an unspecific, highly reactive active substance and no occurrence of resistance has been reported to date, the risk of resistance development is considered low.

c) Overall conclusion of the evaluation including need for risk management measures

Human health

Based on the physico-chemical properties of ozone, it is expected that the main part of the substance reacts with the tissue at the site of contact. Following inhalation, ozone is effectively absorbed. Studies on oral and dermal absorption and on distribution were not submitted.

Classification with Acute Tox. 1 is proposed based on an estimated LC50 in the range of 1-10 ppm.

Ozone has no sensitising properties, but exacerbates allergic asthma in different species of animals and increases the risk for first childhood asthma admission in humans.

Single and repeated dose toxicity studies detected effects in heart (*e.g.* modification of heart rate and bradyarrhythmia), brain (*e.g.* loss of fibers and cell death in dopaminergic neurons as well as memory deficiencies) and respiratory effects (*e.g*. fibrosis, inflammation and necrosis). Based on these effects classification as STOT-SE 1 (nervous system) and STOT-SE 3 (respiratory irritation) is warranted.

There was no clear association between pre- and postnatal exposure to ozone and reproductive toxicity, including fertility, embryotoxic and foetotoxic effects.

Classification with Carc 2 and Muta 2 is proposed based on the available studies.

In principle and in accordance with the CLP Guidance, strong oxidising properties provide a reason for concern for skin irritation/corrosion. The available studies demonstrate some irritating effects, but the studies are not applicable to determine skin as well as eye irritation and corrosion and can only be used as supportive information. Hence, no classification for skin as well as eye irritation is warranted.

Ozone is not considered to be an endocrine disruptor with respect to human health.

For the systemic toxicity of ozone, there is no indication for the existence of NOAECs/NOAELs from the relevant epidemiological studies submitted for the critical effect mortality. In addition, ozone was identified as a suspected genotoxic carcinogen. In the absence of suitable information, the existence of a threshold for this effect cannot be assumed. As AEL values cannot be derived for suspected genotoxic carcinogens without established threshold, a minimal effect level (MEL) of 25 ppb is proposed for the general population in analogy to the DMELs under REACH. Regarding local effects, in controlled human volunteer studies a NOAEC of 60 ppb was derived based on changes in lung function, which can be used for risk assessment for short-term exposure for professionals.

Disinfection of water with ozone leads to the formation of disinfection by-products (DBPs) depending on various parameters (e.g. availability of organic matter, halogens in drinking water or pH value).

The table below summarises the exposure scenarios assessed.

Summary table: human health scenarios			
Scenario	**Primary or secondary exposure[6] and description of scenario**	**Exposed group**	**Conclusion**
Disinfection of bottles in the beverage industry	Ozone *in situ* generation and treatment of water intended to be used for disinfection of bottles (e.g. beverage): Primary exposure of ozone plant operators or general plant workers without PPE, in technical or other rooms (indoor) where either an ozone generator is installed and/or application to water is carried out. Due to a closed system exposure to ozone is not expected.	Professional user (industrial)	Acceptable (closed system)
Dietary exposure	Exposure via bottles /beverage resulting from disinfection of bottles and caps in the food industry rinsed with ozoned water	General public	Acceptable

Professional user:

Ozone is generated from air or oxygen *in-situ* using an ozone generator and then used for disinfection of bottles and caps in the beverage industry with ozonated water. Ozone generation and dosing into the water take place in closed system. Unconsumed excess gas (residual ozone) from closed system passes through an ozone destruction unit (converting ozone to oxygen and venting to the outside atmosphere). The generation is done indoors in locked technical rooms, which are equipped with ventilation or negative pressure and with limited access only for trained professionals. Operators are not present at all time, but occasionally for inspection and maintenance. In normal working operation, there will be no release of ozone to air in the workplace. Failures or malfunctions are dealt with by means of elaborated safety measures (room monitoring with warning and alarm systems, and ozone generation interruption at alarm level, appropriate personal protective equipment like full-face gas filter mask).

Frequent false alarms are more dangerous compared to a higher threshold limit, because people will get used to it and will not react in an appropriate way if there is a “real” alarm. Therefore, the gas detection and warning device will typically be programmed at a higher level than derived reference value MEL, i.e. a peak limit of 600 µg/m^3 = 0.3 ppm, or more commonly 0.5 ppm.

Non-professional user / general public:

Non-professional use is not intended, therefore, no risk assessment was performed.

The general public does not have access to areas where bottle/cap disinfection takes place. Thus, secondary exposure of the general public excluding dietary exposure is expected to be not relevant.

For the intended PT4 uses of ozone involving the treatment of clean bottles and caps with ozonated water, it was concluded that transfer of residual ozone and DBPs from treated surfaces into foods will be low. Consumer exposure to ozone and DBPs via food from the

[6] See document: Terminology primary and secondary exposure (available from https://webgate.ec.europa.eu/s-circabc/d/a/workspace/SpacesStore/80f71044-fce2-43b3-a73c-e156effc9fcb/Terminology%20primary%20and%20secondary%20exposure.pdf)

intended uses will be marginal compared to the uptake of residues via ozonated drinking water.

Environment

Ozone is an atmospheric and highly reactive gas. Atmospheric ozone decomposes to oxygen and short-lived radicals. The approximately half-life in air is 12 hours. Since ozone does not have any hydrolysable groups within its structure, it is not susceptible to hydrolysis. Phototransformation in water is also considered negligible. Self-decomposition and decomposition in contact with organic matter are more relevant.

Ozone rapidly decomposite in contact with metal oxides and soil organic matter with an estimated half-life in soil of < 1 h. Moreover, ozone is not expected to bioaccumulate and is not subject to biodegradation. Ozone is acutely and chronically toxic to fish with lowest effect values being 9.3 µg/L (96h-LC_{50} for *O. mykiss*) and 2.3 µg/L (3 month-NOEC for *O. mykiss*), respectively.

Ozone is not considered to be an endocrine disruptor with respect to non-target-organisms.

The table below summarises the exposure scenarios assessed.

Summary table: environment scenarios		
Scenario	**Description of scenario including environmental compartments**	**Conclusion**
PT4 – Disinfection of bottles in the beverage industry	The use of *in situ* generated ozone for the disinfection of bottles occurs in a closed system indoors. For professional and trained professional use an ozone dosage of up to 1 mg/L is applied. The supposedly emission path will be via air. The active substance evaporates from the washing water into the cleaning bottle chamber indoor air. With the use of a destruct unit emission to air is negligible. As ozone decomposed in the drain water of the bottle wasching system releases are not expected via STP to the aquatic compartment (surface water and sediment) as well as due to sewage sludge application on agricultural soil to the terrestrial compartment (soil and groundwater).	Acceptable

No unacceptable risk for air was identified in connection with the evaluated intended use. The assessed use of the biocidal product does neither lead to direct emissions of ozone to the STP nor to indirect emissions to the aquatic (surface water and sediment) or the terrestrial (soil and groundwater) compartment.

With regard to the formation of disinfection by-products, no conclusive risk assessment could be presented due to the lack ofan agreed guidance for a quantitative environmental risk assessment of disinfection by-products. This assessment will therefore be postponed to either the product authorisation or the renewal of the active substance depending on when an agreement has been reached on guiding principles for an assessment of DBP in the context of the environmental risk assessment.

Overall conclusion

The use of ozone generated from oxygen for disinfection of bottles in the beverage industry by using ozoned water does not result in unacceptable risks for human health or the environment.

2.2. Exclusion, substitution and POP criteria

2.2.1. Exclusion and substitution criteria

The table below summarises the relevant information with respect to the assessment of exclusion and substitution criteria:

Property	Conclusions		
CMR properties	Carcinogenicity (C)	Cat 2	Ozone does not fulfil criterion (a), (b) and (c) of Article 5(1)
	Mutagenicity (M)	Cat 2	
	Toxic for reproduction (R)	no classification required	
PBT and vPvB properties	Persistent (P) or very Persistent (vP)	not P or vP	Ozone does not fulfil criterion (e) of Article 5(1) and does not fulfil criterion (d) of Article 10(1)
	Bioaccumulative (B) or very Bioaccumulative (vB)	not B or vB	
	Toxic (T)	T	
Endocrine disrupting properties	Section A of Regulation (EU) 2017/2100: ED properties with respect to humans	No	Ozone does not fulfil criterion (d) of Article 5(1) or criterion (e) of Article 10(1)
	Section B of Regulation (EU) 2017/2100: ED properties with respect to non-target organisms	No	
	Article 57(f) and 59(1) of REACH	No	
	Intended mode of action that consists of controlling target organisms via their endocrine system(s).	No	
Respiratory sensitisation	No classification required. Ozone does not fulfil criterion (b)		

properties	of Article 10(1).
Concerns linked to critical effects other than those related to endocrine disrupting properties	Ozone does not fulfil criterion (e) of Article 10(1).
Proportion of non-active isomers or impurities	Not relevant. Ozone does not fulfil criterion (f) of Article 10(1).

Consequently, the following is concluded:

Ozone generated from oxygen does not meet the exclusion criteria laid down in Article 5 of Regulation (EU) No 528/2012.

Ozone generated from oxygen does not meet the conditions laid down in Article 10 of Regulation (EU) No 528/2012 and is therefore not considered as a candidate for substitution. The exclusion and substitution criteria were assessed in line with the "Note on the principles for taking decisions on the approval of active substances under the BPR"[7], "Further guidance on the application of the substitution criteria set out under article 10(1) of the BPR"[8] and "Implementation of scientific criteria to determine the endocrine-disrupting properties of active substances currently under assessment[9]" agreed at the 54th, 58th and 77th meeting respectively, of the representatives of Member States Competent Authorities for the implementation of Regulation 528/2012 concerning the making available on the market and use of biocidal products. This implies that the assessment of the exclusion criteria is based on Article 5(1) and the assessment of substitution criteria is based on Article 10(1)(a, b, d, e and f).

2.2.2. POP criteria

Ozone is inorganic and it is not persistent. LRTAP (Long-range Transboundary Air Pollution) is not applicable to ozone from biocidal applications: Only small amounts of ozone are emitted in association with the use as biocide. Furthermore, ozone has a half-life of approximately 12 hours in the planetary boundary layer.

2.3. BPC opinion on the application for approval of the active substance ozone generated from oxygen in product type 4

In view of the conclusions of the evaluation, it is proposed that ozone generated from oxygen shall be approved and be included in the Union list of approved active substances, subject to the following specific conditions:

1. Specification: For ozone generated from the precusor oxygen the specification is set in accordance to DIN EN 12876:2015 with a minimum purity of 90%. Oxygen shall be supplied from sources complying with this norm. For product authorisation, compliance with this norm shall be demonstrated by submission of certificates of

[7] See document: Note on the principles for taking decisions on the approval of active substances under the BPR (available from https://circabc.europa.eu/d/a/workspace/SpacesStore/c41b4ad4-356c-4852-9512-62e72cc919df/CA-March14-Doc.4.1%20-%20Final%20-%20Principles%20for%20substance%20approval.doc)
[8] See document: Further guidance on the application of the substitution criteria set out under article 10(1) of the BPR (available from https://circabc.europa.eu/d/a/workspace/SpacesStore/dbac71e3-cd70-4ed7-bd40-fc1cb92cfe1c/CA-Nov14-Doc.4.4%20-%20Final%20-%20Further%20guidance%20on%20Art10(1).doc)
[9] See document: Implementation of scientific criteria to determine the endocrine –disrupting properties of active substances currently under assessment (available from https://circabc.europa.eu/sd/a/48320db7-fc33-4a91-beec-3d93044190cc/CA-March18-Doc.7.3a-final-%20EDs-%20active%20substances%20under%20assessment.docx).

analysis. For water and air, no specification was set.

2. The authorisations of biocidal products are subject to the following condition(s):

   a. The product assessment shall pay particular attention to the exposures, the risks and the efficacy linked to any uses covered by an application for authorisation, but not addressed in the Union level risk assessment of the active substance.

   b. In view of the risks identified for the uses assessed, the product assessment shall pay particular attention to:

      i. professional users.

   c. For products that may lead to residues in food or feed, the need to set new or to amend existing maximum residue levels (MRLs) in accordance with Regulation (EC) No 470/2009 of the European Parliament and of the Council or Regulation (EC) No 396/2005 of the European Parliament and of the Council shall be verified, and any appropriate risk mitigation measures shall be taken into account to ensure that the applicable MRLs are not exceeded.

The active substance does not fulfil the criteria according to Article 28(2) to enable inclusion in Annex I of Regulation (EU) 528/2012 as ozone is proposed to be classified as Acute Tox. 1 (H330), STOT SE 1 (H370), STOT SE3 (H335), STOT RE1 (H372), Muta. 2 (H341), Carc. 2 (H351), Aquatic acute (H400).

2.4. Elements to be taken into account when authorising products

1. The following recommendations and risk mitigation measures have been identified for the uses assessed. Authorities should consider these risk mitigation measures when authorising products, together with possible other risk mitigation measures, and decide whether these measures are applicable for the concerned product:

   a. If an unacceptable risk is identified for professional users, safe operational procedures and appropriate organizational measures shall be established. Products shall be used with appropriate personal protective equipment where exposure cannot be reduced to an acceptable level by other means.

   b. For products that may lead to residues in food or feed a dietary risk assessment has to be performed at product authorization level. Particular attention should be given to applications that include contact of food with ozone and/or related disinfection by-products.

   c. Data on typical levels of ozone and disinfection by-products in the relevant matrix specific for the intended uses and related conditions shall be provided at product authorisation level.

2.5. Requirement for further information

Sufficient data have been provided to verify the conclusions on the active substance, permitting the proposal for the approval of ozone generated from oxygen.