

**Committee of Experts on the Transport of Dangerous Goods
and on the Globally Harmonized System of Classification
and Labelling of Chemicals**

Sub-Committee of Experts on the Transport of Dangerous Goods

20 June 2024

Sixty-fourth session

Geneva, 24 June-3 July 2024

Item 3 of the provisional agenda

Listing, classification and packing

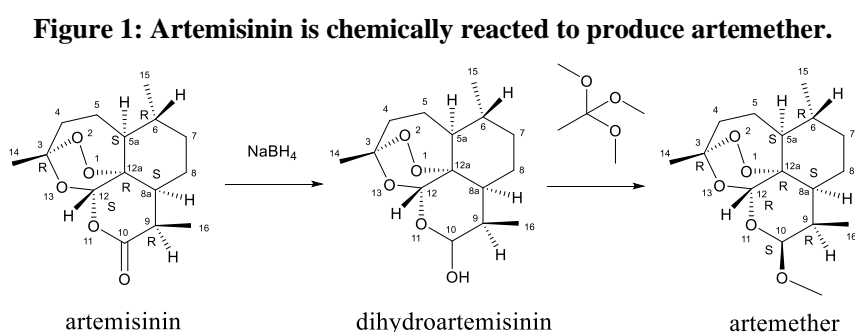
Listing of Artemisinin and derivatives in 2.5.3.2.4

Transmitted by the experts from China and the European Chemical Industry Council (Cefic)

I. Introduction

1. Artemisinin is a natural product with peroxide bridge structure extracted from the plant *Artemisia annua*, which is one of the most effective drugs in the treatment of malaria. A series of derivatives prepared through deep processing of artemisinin are also commonly used in the treatment of malaria. Common artemisinin derivatives include artemether, dihydroartemisinin, arteether, artesunate, etc.

2. At the thirty-eighth session of Sub-Committee of Experts on the Transport of Dangerous Goods, the Sub-Committee adopted the proposal of document ST/SG/AC.10/C.3/2010/53 by including a new entry "[3R-(3R, 5aS, 6S, 8aS, 9R, 10R, 12S, 12aR**)]-DECAHYDRO-10-METHOXY-3,6,9-TRIMETHYL-3,12-EPOXY-12H-PYRANO[4,3-j]-1,2-BENZODIOXEPIN" (UN 3106, organic peroxide type D) to *list of currently assigned organic peroxides in packagings* in *Model Regulations 2.5.3.2.4*. The name of this entry adopts the chemical name of the substance, which is similar to the chemical name of artemether, which is "(3R, 5aS, 6R, 8aS, 9R, 10S, 12R, 12aR)-decahydro-10-methoxy-3,6,9-trimethyl-3,12-epoxy-12H-pyrano[4,3-j]-1,2-benzodioxepin", the difference between the two is the description of the chiral site, The original entry name is inaccurate. Artemether is produced by a chemical reaction of artemisinin (Figure 1).



3. Both artemisinin and artemether contain peroxide bridge structures and exhibit the properties of organic peroxides. Nanjing University of Science & Technology (NJUST), TNO, BAM and other institutions carried out classification tests on artemisinin, and the classification results are UN 3106 (type D organic peroxide) or UN 3108 (organic peroxide type E) (Table 1). In the competent authority approval of the U.S. Department of Transportation and the Swiss Federal Inspectorate of Dangerous Goods, the classification results of artemether is UN 3106 (organic peroxide type D) (Table 2).

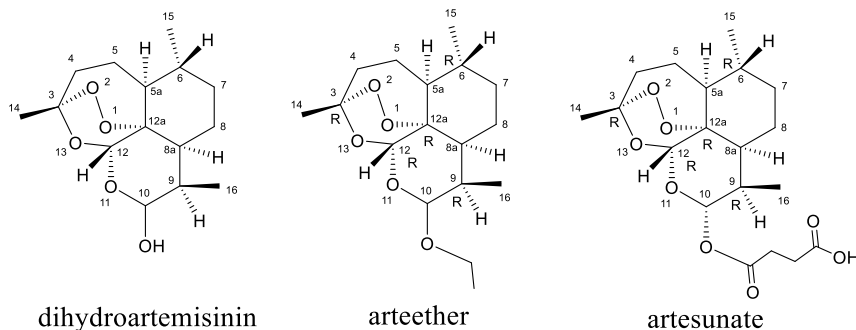
Table 1: The classification results of artemisinin.

Date	Institutions	Test result
December 2011	NJUST	UN3106, 5.2, Organic Peroxide Type D
November 2012	TNO	UN3108, 5.2, II, Organic Peroxide Type E
April 2014	BAM	UN3106, 5.2, Organic Peroxide Type D

Table 2: The classification results of artemether.

Approval No.	Competent Authority	Classification Result
CA20060800 15 (3 rd Rev.)	U.S. Department of Transportation	UN3106, 5.2, II, Organic Peroxide Type D, OP7
Cert. No. 4'205'570	Swiss Federal Inspectorate of Dangerous Goods	UN3106, Organic Peroxide Type D, OP7

4. The entry "[3R-(3R, 5aS, 6S, 8aS, 9R, 10R, 12S, 12aR**)]-DECAHYDRO-10-METHOXY-3,6,9-TRIMETHYL-3,12-EPOXY-12H-PYRANO[4,3-j]-1,2-BENZODIOXEPIN" in 2.5.3.2.4 needs to be corrected for its inaccurate name. Due to the chemical name is complex and easy to make mistakes when using, consider amending it to a generic name. Considering that artemisinin, artemether and other common artemisinin derivatives have similar molecular structures, all contain peroxide bridges (Figure 2), and exhibit the properties of organic peroxides, in order to facilitate the transportation of these goods, artemisinin or its derivatives are considered to be put into the same entry, classified as UN 3106, organic peroxides type D, packaging method OP7. If the substance has further classification test results according to *Manual of Tests and Criteria*, it shall be classified into the appropriate type based on the test results.

Figure 2: Other common artemisinin derivatives.

5. During the meeting of the International Group of experts on Unstable Substances – working group Energetic and Oxidising substances (IGUS-EOS), April 24-25, 2024, Manchester, the above content was discussed, and consensus was reached on the amendment of entry names and proposal for classification results.

II. Proposal

6. The authors propose to make the following change in 2.5.3.2.4:

Replace:

<i>ORGANIC PEROXIDE</i>	<i>Concentration (%)</i>	<i>Diluent A (%)</i>	<i>Diluent B (%)</i>	<i>Inert solid (%)</i>	<i>Water</i>	<i>Packing Method</i>	<i>Control temperature (°C)</i>	<i>Emergency temperature (°C)</i>	<i>Numbrt(Generic entry)</i>	<i>Subsidiary risks and remarks</i>
([3R-(3R,5aS,6S,8aS,9R,10R,12S,12aR**)]-Decahydro-10-methoxy-3,6,9-trimethyl-3,12-epoxy-12H-pyrano[4,3-j]-1,2-benzodioxepin)	≤100					OP7			3106	

By:

<i>ORGANIC PEROXIDE</i>	<i>Concentration (%)</i>	<i>Diluent A (%)</i>	<i>Diluent B (%)</i>	<i>Inert solid (%)</i>	<i>Water</i>	<i>Packing Method</i>	<i>Control temperature (°C)</i>	<i>Emergency temperature (°C)</i>	<i>Numbrt(Generic entry)</i>	<i>Subsidiary risks and remarks</i>
Artemisinin or its derivatives	≤100					OP7			3106	35)

and to add the following Note to 2.5.3.2.4:

“35) Includes artemisinin, artemether, dihydroartemisinin, arteether, artesunate, and other derivatives with a similar peroxide bridge structures. If further test results are available, it shall be classified appropriately based on the test results.”