TEST PROTOCOLS FOR DESIGNATED LABORATORIES

Leaching of substances from products used in contact with water intended for human consumption

Protocol 5
Water treatment membranes

Version 2.5 – June 2016
INTRODUCTION
This test protocol is one of a series prepared by the Drinking Water Inspectorate (DWI) to provide guidance to test laboratories on procedures to be used in evaluating the suitability of products for use in the treatment and distribution of water intended for human consumption. These procedures are designed to ensure a consistent approach to testing by the designated test laboratories.

The protocols currently available are listed below.

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IMPACT OF EUROPEAN TECHNICAL REQUIREMENTS
Currently a whole series of test methods are being prepared within CEN in support of the approval of products used with water intended for human consumption. As these are published any conflicting national test protocols will have to be withdrawn. It is currently anticipated that published EN standards will become available for most of the areas covered by these protocols during the next few years. As these are published, the affected protocols will be withdrawn or modified, as appropriate.

AVAILABILITY
Copies of these test protocols, together with information requirements for applicants, can be freely downloaded from our website – [http://www.dwi.gov.uk/drinking-water-products/advice-and-approval/index.htm](http://www.dwi.gov.uk/drinking-water-products/advice-and-approval/index.htm)

CONTACT
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Revision notes –
Version 2 – major revision of two previously issued test protocols (5.1 and 5.2) following publication of BS EN 12873-4
Version 2.1 – revisions to reflect new approval processes and requirements; Version 2.2 – clarification of filter types NOT covered by this protocol (Section 1) and changes in regulatory requirements; Version 2.3 - Address change ; Version 2.4 amendment to sections 4.3, and 4.4; V2.5 changes to England and Wales Regulations
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GENERAL DEFINITIONS (for use with all Test Protocols)

The relevant regulations (for public drinking water suppliers)
The following regulations apply to the approval of substances and products used in the provision of public water supplies within the United Kingdom:


Where reference is required to specific regulatory requirements, these are given in footnotes.
PROCEDURE FOR THE DETERMINATION OF LEACHING FROM WATER TREATMENT MEMBRANES

1. INTRODUCTION
The procedures in this test protocol are applicable for testing a range of membrane based water treatment units (e.g. microfiltration, ultrafiltration, nanofiltration, and reverse osmosis membranes, plus membrane based electro-dialysis units) for the possible effects on drinking water quality.
Note – the evaluation of the efficiency of the membrane filters in removing contaminants from the treated water is not included.

Leachates are prepared in accordance with BS EN 12873-4 unless otherwise stated.
Note – BS EN 12873-4 is based on the CWA document CWA 14247:2001 with modifications.

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<th>IMPORTANT NOTE</th>
<th>this Test Protocol is not applicable to the following filter types –</th>
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<td>1)</td>
<td>Depth filters – most of the filtration media used for these filters, e.g. sand, granular activated carbon (GAC), are covered by published BS EN standards – see section 2.2 of Appendix 2 of the “List of Approved Products” (<a href="http://www.dwi.gov.uk/drinking-water-products/approved-products/index.htm">http://www.dwi.gov.uk/drinking-water-products/approved-products/index.htm</a>).</td>
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<td>2)</td>
<td>Course (screening) filters – typically these will be used as pre-filters to remove particulate matter from water – each of the non-metallic components of the filter housing and of the filter medium (membrane) should meet the normal requirements of the relevant regulations – see Advice Sheet 1 (<a href="http://www.dwi.gov.uk/drinking-water-products/advice-and-approval/Advicesheet1.pdf">http://www.dwi.gov.uk/drinking-water-products/advice-and-approval/Advicesheet1.pdf</a>).</td>
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<td>3)</td>
<td>Mechanical filters, e.g. centrifugal filters, screens – each of the non-metallic components of the filter housing and of the filter screen/disks should meet the normal requirements of the relevant regulation – see Advice Sheet 1.</td>
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2. TERMS AND DEFINITIONS
For the purposes of this test protocol, the terms and definitions given in Section 3 of BS EN 12873-4 apply, plus:

target substance
regulated parameter or a chemical originating from either the test sample or as a reaction product that results from other processes such as chlorination, cleaning or disinfection for which leaching data is required

3. TEST METHOD
Leachates are prepared in accordance with Section 5 of BS EN 12873-4, except that each product is tested in duplicate. The tests may be carried out in parallel using two test rigs, or in series on the same test rig, provided that the second test is preceded by another procedural blank test.

Where the membrane is designed for use with chlorinated water, test one of the units using test water (5.2.2 of BS EN 12873-4) containing (1±0.2)mg/l as free-chlorine.
4 SAMPLE ANALYSIS

4.1 General
Analyse the test leachates and procedural blanks as specified by the Drinking Water Inspectorate (DWI). The analyses shall be carried out in accordance with the requirements specified in 4.2 to 4.5.

NOTE Preparation and analysis of positive controls (test water spiked with the specific substances and kept under the conditions of the test) would only be required if the samples concentrated by recycling (R) were to be analysed for specific substances.

4.2 Determination of TOC
The limit of detection of the analytical method shall be 0.1 mg/l of carbon. The relative standard deviation shall be 10%.

The AQC procedure shall include the analysis of the analytical blank sample and a spiked AQC sample with each batch of leachates from the test. The results shall be included in the test report.

Note: samples should be analysed in accordance with a standard analytical method, e.g. that given in EN 1484:1997.

4.3 General survey GC-MS
The concentrated extracts, together with the single pass samples T1, T2 and T3, shall be analysed in accordance with the standard analytical method BS 6920-4: 2001.

4.4 Odour and flavour assessment
Divide each of the single pass samples T1, T2 and T3 into two portions and assess one of the portions in accordance with procedure set out below in this section. Treat the other portion in accordance with clause 10.4.2 of BS 6920-2.2.1:2000 before undertaking an odour and flavour assessment on it.

Note: the chlorination of test extracts is undertaken to ensure that in-service no odour and flavour problems will occur if chlorination of treated water is undertaken downstream of the water treatment unit.

The extracts (before and after chlorination) shall be tested in accordance with either the full method (clause 10.3), paired unforced test (10.3.2.2 and 10.3.3.2) of EN 1622: 1999, or in accordance with clause 10.2.3 (Assessment of extract(s) and their dilutions) of BS 6920-2.2.1:2000, using test water (3.2.2) as the blank for comparative purposes. The concentrated leachates, R, shall not be submitted for this assessment.

In the test report (6) state which method was used to assess the odour and flavour of the leachates.

4.5 Specific substances
Refer to section 5.5 of Test Protocol 2.

5 EXPRESSION OF RESULTS
This shall be in accordance with Section 7 of BS EN 12873-4.
6 TEST REPORT
In addition to the appropriate test report requirements set out in Protocol 1 (Reporting Requirements) and the specific requirements of Section 8 of BS EN 12873-4, the test report shall contain the following specific details:

a. comprehensive details covering the design of the test rig, together with the mode of operation of the test rig, and the collection of the test leachates, plus a “time line” of the complete process of leachate preparation and analysis
b. location where the test rig was installed and run
c. full details of security arrangements if the test rig was installed and run at a remote location
d. description of how the test samples were transferred to the test laboratory if the test rig was run at a remote location
e. for each substance the method of analysis and the source of the method, including the detection limit and estimates of accuracy
f. the estimated concentrations in the extracts presented in tabular form and any calculations used, such as blank and/or recovery corrections
g. calculated normalised migration rates presented in tabular form.
ANNEX A. ELECTRO-DIALYSIS MEMBRANE UNITS

A.1  Introduction.
With the following exceptions, test these units in accordance with BS EN 12873-4 and the analytical and reporting requirements set out in the main body of this test protocol.

A.2  Information on the membrane unit
Obtain the following information, not required under Section 5.3.1 of BS EN 12873-4 –
- effective surface area of the membrane in the complete stack and in the individual cell exposed to the test water

Note: a flow reversal occurs with many systems as part of their normal operation conditions; the surface area should be calculated, however, on the basis of one surface, not both.

A.3  Sample Analysis – General
In addition to the requirements set out in Section 4.1 of this test protocol, determine the conductivity in all test sample leachates in order to check for carry over from the cell pairs after the DC reversal.
BIBLIOGRAPHY

<table>
<thead>
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<td>Suitability of non-metallic products for use in contact with water intended</td>
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<td>for human consumption with regard to their effect on the quality of water.</td>
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