



**APPROVAL OF PRODUCTS FOR
USE WITH DRINKING WATER**

TEST PROTOCOLS FOR DESIGNATED LABORATORIES

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

**Protocol 5
Water Treatment Membranes**

DOCUMENT CONTROL

The only controlled version of this document can be accessed on the [DWI Website](#). Printed copies of this document, together with electronic copies held on local computers and other storage devices are uncontrolled.

Version 2.7 – June 2022

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.

| Number | Title |
|--------|---|
| 0 | Designated test laboratory requirements |
| 1 | Leaching of substances from products used in contact with water intended for human consumption: Reporting requirements |
| 2 | Leaching of substances from products used in contact with water intended for human consumption: General Method |
| 3 | Leaching of substances from products used in contact with water intended for human consumption: Cement admixtures and concrete - <i>provisional</i> |
| 4 | Leaching of substances from metallic products used in contact with water intended for human consumption: General method - <i>provisional</i> |
| 5 | Leaching of substances from products used in contact with water intended for human consumption: Water treatment membranes |
| 6 | Leaching of substances from non-metallic products used in contact with water intended for human consumption: Filter media and ion exchange resins |

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 As these are published any conflicting national test protocols will have to be withdrawn.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 As these are published, the affected protocols will be withdrawn or modified, as appropriate.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](#).

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; V2.6 Update existing references; V2.7 minor editorial changes

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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:

- a) England - Regulation 31 of [The Water Supply \(Water Quality\) Regulations 2016](#) (Statutory Instruments 2016 No 614)
- b) Wales – Regulation 31 of [The Water Supply \(Water Quality\) Regulations 2018](#) (Welsh Statutory Instrument 2018 No 647 (W.121))
- c) Scotland – Regulation 33 of [The Public Water Supplies \(Scotland\) Regulations 2014](#)
- d) Northern Ireland – Regulation 30 of [The Water Supply \(Water Quality\) \(Amendment\) Regulations \(Northern Ireland\) 2009](#) (Statutory Rules of Northern Ireland 2009 No.246)

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.

IMPORTANT NOTE – this Test Protocol is not applicable to the following filter types –

- 1) 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](#)”.
- 2) 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](#).
- 3) 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](#).

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:

specific determinand

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 and has been specified in test requirements.

3 TEST METHOD

Leachates are prepared in accordance with Section 5 of BS EN 12873-4, except that each product may be 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.

The test requirements letter from DWI will determine the number of units required for testing.

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.

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 EN 15768.

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 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, *or* in accordance with clause **10.2.3** (Assessment of extract(s) and their dilutions) of BS 6920-2.2.1, 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
- h. calculated “At tap” concentrations for substances detected

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

| | |
|----------------|---|
| BS 6920-2.2.1 | Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of water. Part 2. Methods of test. Section 2.2.1 – Odour and flavour of water. General method of test. |
| BS EN 15768 | Influence of materials on water intended for human consumption – The GCMS identification of water leachable organic substances |
| BS EN 1484 | Water analysis. Guidelines for the determination of total organic carbon (TOC) and dissolved organic carbon (DOC) |
| BS EN 1622 | Water analysis. Determination of the threshold odour number (TON) and threshold flavour number (TFN) |
| BS EN ISO 3969 | Water for analytical laboratory use. Specification and test methods |
| BS EN 12873-4 | Influence of materials on water intended for human consumption – Influence due to migration – Part 4: Test method for water treatment membranes |
| ISO/TS 13530 | Water quality – Guide to analytical quality control for chemical and physiochemical water analysis |