

INTERNATIONAL STANDARD

ISO 11401

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Plastics — Phenolic resins — Separation by liquid chromatography

*Plastiques — Résines phénoliques — Séparation par chromatographie en
phase liquide*



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 11401 was prepared by Technical Committee ISO/TC 61, *Plastics*, Sub-Committee SC 12, *Thermosetting materials*.

Later, this International Standard will become part of a general standard concerning liquid chromatography.

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Plastics — Phenolic resins — Separation by liquid chromatography

1 Scope

1.1 This International Standard specifies chromatographic methods for the separation of phenolic resins into their component compounds. Separation takes place according to molecular weight and/or polarity.

There are various liquid chromatographic methods:

A: Gel-permeation chromatography

B: High-performance liquid chromatography on polar columns

C: High-performance liquid chromatography on non-polar columns

It is possible to separate a phenolic resin into its components according to molecular size using method A (gel-permeation chromatography). Whereas free phenol and the sum of the dihydroxydiphenylmethanes (in novolaks) and various methylolphenols (in resols) are quantitatively separated in this procedure, high-molecular-weight components of the resins are only incompletely separated due to the multitude of isomers.

Methods B and C (high-performance liquid chromatography) separate the compounds in the resin according to molecular weight *and* polarity. Molecular-weight effects predominate on polar stationary phases (method B), and the effect of polarity on non-polar stationary phases (method C). These methods also allow quantitative determination of individual low-molecular-weight resin components. Because of the different resin solubilities, method B is more suitable for novolaks and method C for resols.

1.2 The methods are applicable to phenolic resins that are soluble in the solvents and solvent blends used.

1.3 This test is useful for characterization of products and for research.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 472:1988, *Plastics — Vocabulary*.

ISO 10082:1991, *Plastics — Phenolic resins — Definitions and test methods*.

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 phenolic resin: Generally, a class of resins made by the polycondensation of phenol, its homologues and/or derivatives, with aldehydes or ketones. [ISO 472]

3.2 novolaks: Non-self-curing, soluble, fusible phenolic resins that remain stable when stored, the phenol nuclei of which are linked primarily by methylene bridges. Novolaks can be made to react further and crosslink by the addition of hardeners; heating is also usually necessary. [ISO 10082]

See also *novolak* in ISO 472.

3.3 resols: Soluble, fusible phenolic resins which, in contrast to novolaks, contain methylol groups and methylene-ether and sometimes also methylene-amine bridges. Resols are self-curing; they crosslink into insoluble products when heated and/or mixed with catalysts, without addition of further reaction components. Resols are perishable and can be stored for a limited time only. [ISO 10082]