Ibuprofen Tablets, Sustainability Case Study – BP 2026

Assay Scaled Method Information

The Assay method for the Ibuprofen Tablets monograph published in the BP 2026 was assessed using geometric scaling of column dimensions and chromatographic parameters, with the intention of reducing solvent use and environmental impact. This work is complementary to section 3.3 of the Environmental sustainability information pack - British Pharmacopoeia.

Appendix III Chromatographic Separation Techniques (Ph. Eur. method 2.2.46) details the extent to which the various parameters of a chromatographic test may be adjusted without fundamentally modifying the pharmacopoeial analytical procedure. Users are advised to refer to this text when investigating scaled method approaches to determine whether full revalidation is needed.

We would be grateful for any feedback you have on the content of this additional information and interested to hear your own case studies. Please contact us by email at BPsustainability@mhra.gov.uk.

The purpose of the case study was to give an illustration of the solvent, energy and efficiency savings that can be obtained through scaling down column dimensions and chromatographic conditions without fundamentally modifying the pharmacopoeial analytical procedure. A full validation of the scaled method has not been carried out.

Case Study Selection Criteria

The Ibuprofen Tablets Assay method was identified as a candidate for scaling based on the following criteria:

- The LC method is isocratic
- The method is used for Assay, Dissolution and/or Uniformity of Content
- The original column dimensions are big enough to allow for scaling reductions
- The Assay and Related Substances methods in the monograph published in the BP 2025 are not harmonised
- The injection volume is less than 100 µL

Experimental Procedure

The viability of scaled conditions for the Ibuprofen Tablets Assay method was investigated by reducing the column dimensions and, by extension, the flow rate and total mobile phase consumption. A column was used with a shorter length (10 cm) and smaller particle size (3 µm) than the one specified in the published monograph (25 cm x 4.6 mm, 10 µm).

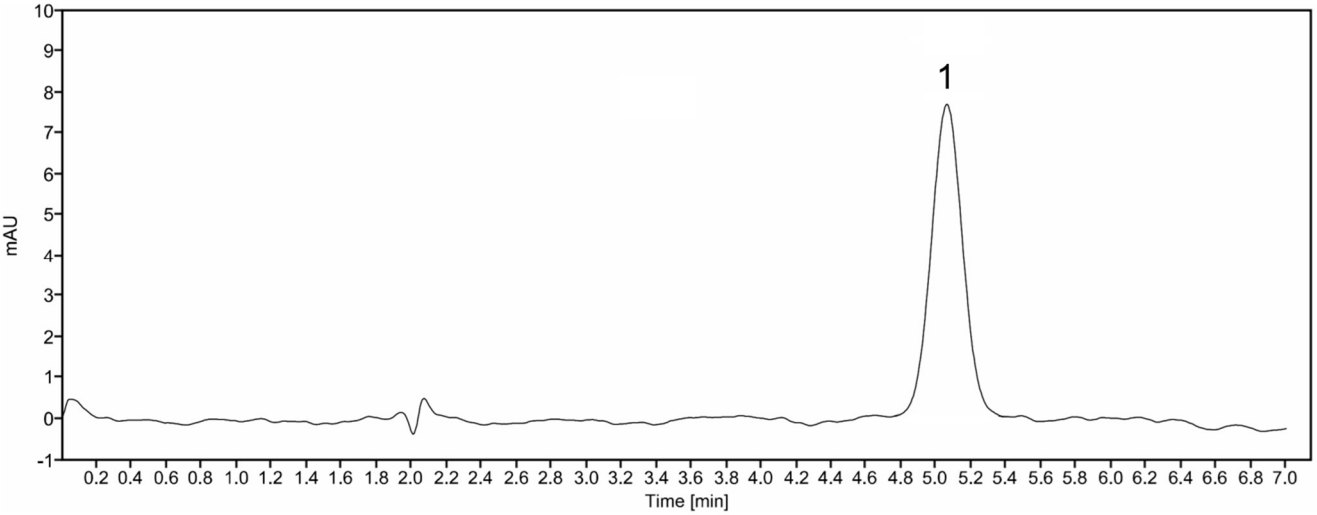
A freely available online HPLC Method Transfer Calculator was used to provide a modified flow rate, injection volume and run time as per the allowed changes in Appendix III of the British Pharmacopoeia. The Sigma Aldrich tool was used for the purpose of this investigation, however many equivalent tools are available. The final method parameters are listed below:

Table 1 Method Transfer Calculator Output

	Published method	Scaled method
Column length (cm)	25	10
Column I.D. (mm)	4.6	As per published method
Particle size (µm)	10	3
Flow rate (mL/min)	1.5	As per published method
Injection volume (µL)	20	8
Pressure (bar)	108	223
Run time (min)	7	3
Time saved per injection (min)	–	4
Solvent saved per injection (mL)	–	4.5 ~57% reduction

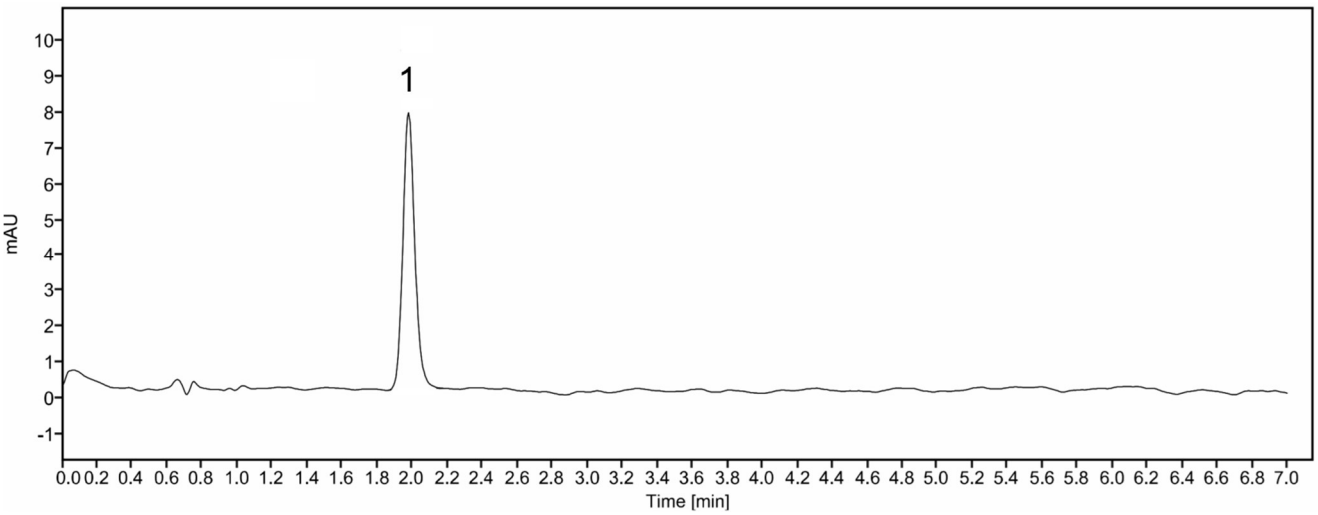
Results

A typical chromatogram for solution (2) from the Assay test for Ibuprofen Tablets as published in BP 2026.



Peak ID: 1: Ibuprofen.

A typical chromatogram for solution (2) from the Assay test for Ibuprofen Tablets using scaled chromatographic conditions.



Peak ID: 1: Ibuprofen.

Table 2 Published versus Scaled Chromatographic Conditions

	Published	**Scaled**
Column	Nucleosil C18 (25 cm x 4.6 mm, 10 µm)	Nucleosil C18 (10 cm x 4.6 mm, 3 µm)
Method reference	BP 2026 monograph, Assay for Ibuprofen Tablets	
Mobile phase	Orthophosphoric acid: water: methanol (3:247:750, v/v/v)	
Diluent	Mobile phase	
Flow rate	1.5 mL/min	
Column temp	Ambient	
Autosampler temp	Ambient	
Injection volume	20 µL	8 µL
Detection	264 nm	

Chromatograms are provided for information only as an aid to analysts and are intended as guidance.

A summary of the differences in the method parameters and results between the published monograph method and scaled conditions is given below:

Table 3 Summary of Results

Parameter	**Published**	**Scaled**
Resolution between ibuprofen and impurity E (>1.5)	2.2	2.2
Retention time (min)	5.1	2.0
Peak asymmetry (0.8 – 1.8)	1.1	1.0 – 1.2
Theoretical plates	3730	4093
Linearity ($r^2 \geq 0.99$, 0 – 120% test solution concentration)	1.0	1.0
Injector repeatability (%RSD ≤ 1.0%, 6 injections of solution 2)	0.87	0.97

Scaling the method resulted in a reduction of mobile phase consumption of ~57%, and a reduction in run time of ~57% whilst maintaining acceptable chromatography.