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NOMENCLATURE OF LIQUID CHROMATOGRAPHY

ON THE DESCRIPTION OF SMALL-DIAMETER COLUMNS USED IN LIQUID CHROMATOGRAPHY

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CONTENTS

1. INTRODUCTION

In a recent interesting series of papers on the nomenclature of chromatography[1–3], Ettre drew attention to the fact that the development of the current nomenclatural practice in liquid chromatography (LC) has been very different from that for gas chromatography (GC). The nomenclature of the GC developed within a decade amongst a small, fairly close-knit group of scientists. On the other hand, whilst LC has developed over a similar time period, a much larger number of workers have been involved, so that no corresponding closely knit, well organised group has existed. It is therefore possible that this lack of organised co-operation has been partly responsible for the laxity of certain nomenclatural practices in LC which are now to be discussed.

In Parts I[1] and II[2] of the above series of papers, Ettre drew attention to the difficulties experienced in both GC and LC with regard to the description of the internal diameter of the columns employed. Thus, in only one of four nomenclatural systems studied by Ettre was the term capillary column rigorously defined, and this was by the British Standards system[4]: "a column of capillary dimensions, generally less than 1 mm internal diameter". However, Ettre goes on to point out that whilst the IUPAC nomenclature does not define the term capillary, it does emphasize that this refers to a dimension rather than a column type. Further, Ettre indicated that recently this distinction has become important in LC because of a trend towards smaller-diameter columns. He also goes on to state[2] that "any future revision of the nomenclatures must present clear definitions and terms for the columns prepared from small-bore tubing". It is the intention of the present authors to provide evidence for the confused situation which is now prevalent in the LC literature with regard to the description of small diameter columns and also to make a detailed proposal for a scheme which (if universally adopted) would completely clarify the situation.

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2. STUDY OF THE PRESENT DESCRIPTIONS OF SMALL-DIAMETER COLUMNS IN THE LC LITERATURE

Small-diameter columns in the context of the present paper are considered to be LC columns of internal diameters less than approximately 3000 μm. This definition was chosen since standard "analytical" columns routinely used are usually in the range 3.9–4.6 mm I.D.

The present study started by investigating selected literature in our laboratory files which had been grouped under the loose heading of "LC using small-diameter columns". This file consisted of papers from a total of seven journals; of these, five were major chromatographic journals, namely *Analytical Chemistry*, *Chromatographia*, *Journal of Chromatography*, *Journal of Chromatographic Science*, and *Journal of High Resolution Chromatography and Chromatographic Communications*, while the other two journals represented were *Clinical Chemistry* and *Carlsberg Research Communications* because of our particular research interests. The time period covered by the papers was from 1967–1982, but over 90% of the papers had been published during the last five years, 1978–1982.

The papers in this file were then abstracted to ascertain (i) the description of the columns employed, (ii) the actual I.D. of the columns employed, and the number of times the description occurred in either (iii) the title, or (iv) the text of the paper.

The results of this abstracting study are summarised in Table 1, and full bibliographic details are given elsewhere[5].

Before proceeding to discuss Table 1 it should be noted that the information listed in the table was abstracted from a total of 59 *separate* papers, written by 21 authors and published in the seven journals described. Naturally, there was some degree of overlap, in that some papers were abstracted under more than one heading.

TABLE 1

SUMMARY OF DETAILS OF SMALL-DIAMETER LC COLUMNS (I.D. ≤ 2800 μm) AND DESCRIPTIVE TERMS APPLIED, ABSTRACTED FROM SELECTED PAPERS (1967–1982)

Description of column	*Corresponding range of column I.D. (μm)*	*Number of citations*	
		Title	*Text*
Capillary	10–300	4	10
Microcapillary	30–200	13	17
Narrow-bore capiliary	32–72	0	1
Micro	10–1000	14	19
Microbore	50–2800	5	12
Ultramicro	100–150	1	1
Narrow-bore	250–1000	3	5
Small-bore	50–2000	3	5
Small-diameter	2000	1	4

3. DISCUSSION

The first conclusion to be drawn from a study of columns 1, 3 and 4 of Table 1 is that there are at present a total of nine different descriptions of small-diameter columns which fall within the range of internal diameter 10–2800 μm. All but one of these descriptions appear in the titles of the papers (see third column) and hence would be expected to be used as keywords by the compilers of computer bibliographic data bases and abstracting journals.

More importantly, a comparative study of the first two columns of Table 1, leads to the conclusion that unfortunately, with the possible exception of the three descriptive terms involving the word capillary, these descriptions *cannot* be correlated with any particular range of internal diameters. This lack of specificity of the descriptive terms used in both the titles and text of current LC papers must lead to problems when these are abstracted and ambiguities when they are discussed. Further, the present situation must result in additional costs to both the compilers and users of bibliographic abstracting systems since a total of at least nine Keywords must be employed to ensure complete coverage of the literature. We are therefore of the considered opinion that this present varied and non-specific nomenclatural situation should be remedied.

There are two possible solutions to the problem: the first is to re-define the descriptive terms so that they do in fact correlate with a particular range of internal diameters. The second possible solution is to discard the use of descriptive terms altogether and to specify the actual internal diameter used which must of course be measured in some agreed appropriate units. Of these, the second solution would be the simplest, since it would not involve the re-definition and adoption of the descriptive terms listed in the first column of Table I.

It is therefore proposed that when authors are reporting the use of small-diameter columns in future they should give the actual internal diameter of the column (in μm) in parentheses, following the general description of the column as open or packed. Thus a "packed microbore column" I.D. 1000 μm and an "open capillary column" of I.D. 50 μm would be designated as a packed column (1000) and an open column (50) respectively. It should perhaps be noted that a similar numerical system of indicating physical properties of columns is already widely used in gel permeation chromatography involving Sephadex gels, where the water regain volume of the support (*G* value), is normally given in the description of the column.

We hope therefore that the publication of this short note will serve not only to alert LC chromatographers to the present ambiguous situation regarding the description of small-diameter columns but will also provide them with a simple solution which will be readily adopted.

4. SUMMARY

A review of the names given to small-diameter columns used in recent LC studies is presented and discussed. It is shown that none of the nine names currently used to describe these small-diameter columns are in fact specific. The paper concludes with recommendation that in future the actual numerical value of the internal diameter of the column (measured in μm) should follow in parenthesis the description of the column.

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