

## Citation Classics

Trevelyan W E, Procter D P & Harrison J S. Detection of sugars on paper chromatograms. *Nature* 166:444-45, 1950.

**A developed chromatogram is dried and drawn through a solution of silver nitrate in aqueous acetone. The solvent is allowed to evaporate, and the paper sprayed with NaOH in aqueous ethanol. Reducing sugars produce dense black spots of silver at room temperature, unreacted silver hydroxide being then removed by immersing the paper in ammonia solution. [The SC<sup>®</sup> indicates that this paper was cited 2,248 times in the period 1961-1975.]**

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"In 1949 I was working on the composition of spent molasses from a distillery, in a newly-established water pollution research laboratory which had the task of disposing of the waste by anaerobic digestion. Equipment was minimal, and when I decided to look at the sugars present using the then new technique of paper chromatography, my chromatographic tank was constructed from the classic drain-pipe. No suitable oven was available, and after some exasperating failures I decided to develop a method of locating sugars on paper chromatograms which did not require the application of heat. A spot test described by Feigl seemed promising, but when a chromatogram was sprayed with silver nitrate solution followed by NaOH solution, the sugars ran badly. I mentioned to a colleague, famous for his gnomish utterances, that water caused trouble: Why have water, then?' said he, looking insufferably smug. Some time later it struck me that this oracular pronouncement perhaps had some sense in it.

"A search through the handbooks suggested that acetone, in which common sugars are not very soluble, but in which silver nitrate dissolved to some extent, fitted the requirements. It immediately occurred to me that it ought to be possible simply to dip the paper in an acetone

solution of silver nitrate, more especially as spraying such a volatile and inflammable liquid would be difficult, not to say dangerous. This was, as far as I know, the first example of the dipping technique for applying reagents to paper chromatograms, which later became very popular. For some reason which I have forgotten I preferred to spray the silver nitrate-impregnated chromatogram with the alcoholic NaOH solution. Subsequently, other workers applied the dipping technique here, too, and suggested thiosulphate instead of the unpleasant ammonia solution for fixing the chromatogram.

"Dr. S.M. Partridge of the Low Temperature Research Station, Cambridge, [England] was kind enough to try the technique. He suggested I publish a description of it, and this I did in 1950 after joining the Distillers Company Ltd. yeast research unit at Epsom [Surrey, England], where a similar method was developed using triphenyltetrazolium chloride with practical assistance from D.P. Procter, a technician, and encouragement from Dr J.S. Harrison, then head of the biochemical section at Epsom

"Identification of sugars is a constantly recurring problem, especially in industrial laboratories, and I am not surprised that the method is widely used, as it is simple and requires no particular skill. It is also quite dramatic; many people, I find, experience a kind of aesthetic satisfaction in watching the spots come up. The silver nitrate dipping technique for visualising sugar spots is not suited to thin-layer chromatography (TLC), but my impression is that TLC of sugars in general has no advantage over paper chromatography.

"As to why the original paper has been so frequently cited, I have no idea I wonder how many people who include it in their reference list have actually read it. No matter: I find a quiet satisfaction that the paper has become a Citation Classic, regarding it, as I do, as a flag stuck in the map for the small man, the lone worker long on enthusiasm but short on equipment, who does his best with what there is at hand. And I like to think that many found the method particularly useful."