

# Investigation of a Hydrophilic Prototype Anion-Exchange Phase

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## COMPARISON OF COLUMNS

Three hydroxide selective columns were compared in this work: the Dionex IonPac<sup>®</sup> AS11-HC, the IonPac AS21, and a more hydrophilic prototype column. Relative to standard columns, these three columns are higher capacity columns. A variety of test solutes were employed in this work.

A series of inorganic anions of varying retention characteristics were analyzed, including fluoride, chloride, nitrate, sulfate, thiosulfate, iodide, phosphate, citrate, perchlorate, and hexafluorophosphate. The latter ions are difficult to elute without strong eluent conditions and requires organic solvent such as acetonitrile using many stationary phases. A series of aromatic sulfonates were also chromatographed including benzenesulfonates, naphthalenesulfonates, and finally sulfonated dyes.

The columns were tested using a hydroxide gradient from 5 to 70 mM in 25 min was followed by an immediate return to initial conditions. The prototype column was also used with 20% acetonitrile.

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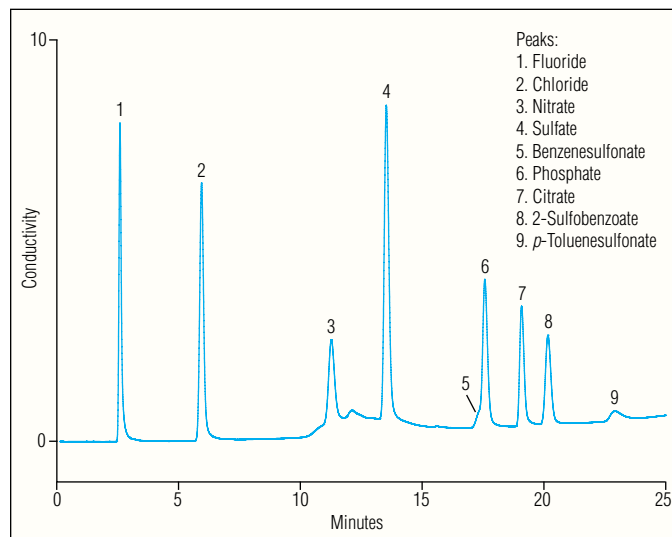


Figure 1. Anion separation on an IonPac AS11-HC column using a sodium hydroxide gradient from 5 to 70 mM.

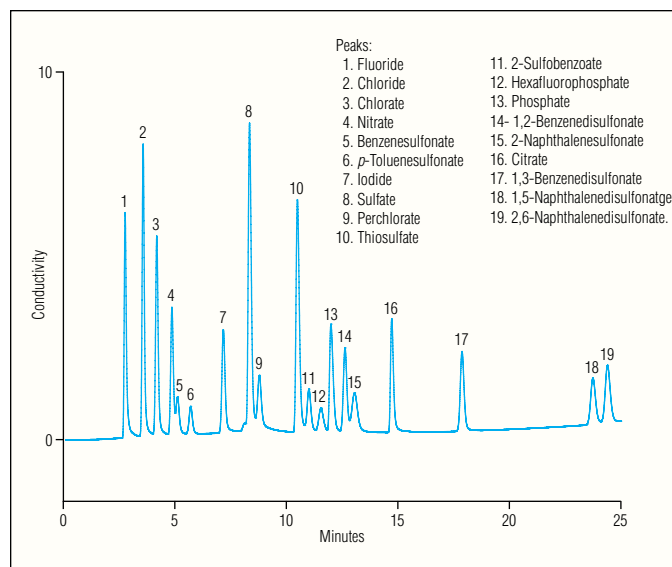


Figure 2. Anion separation on an IonPac AS21 column.

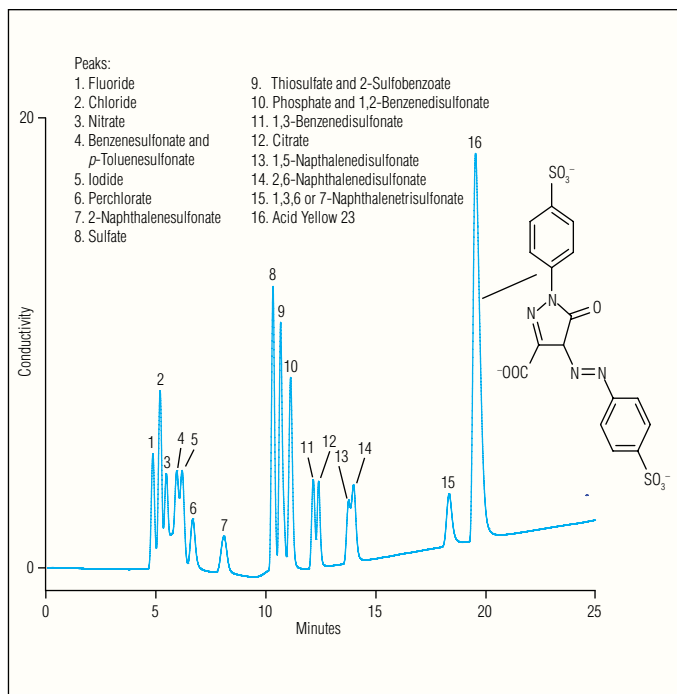


Figure 3. Anion separation on the prototype column.

## PROTOTYPE COLUMN CHROMATOGRAMS

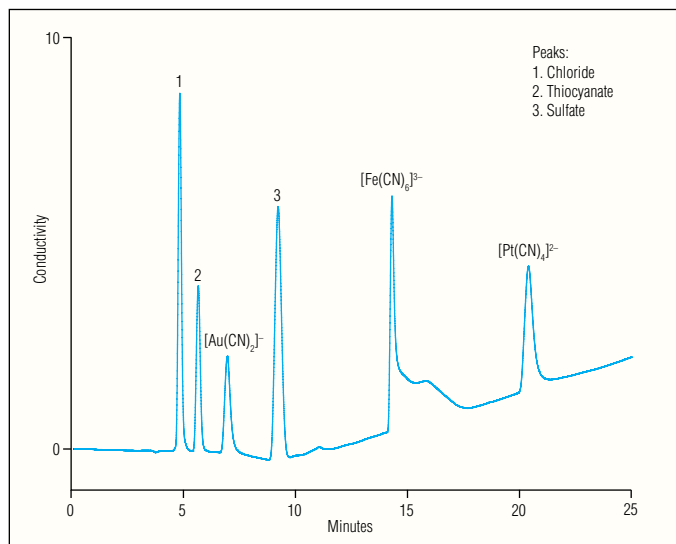


Figure 4. Metal-cyano complexes on the prototype column.

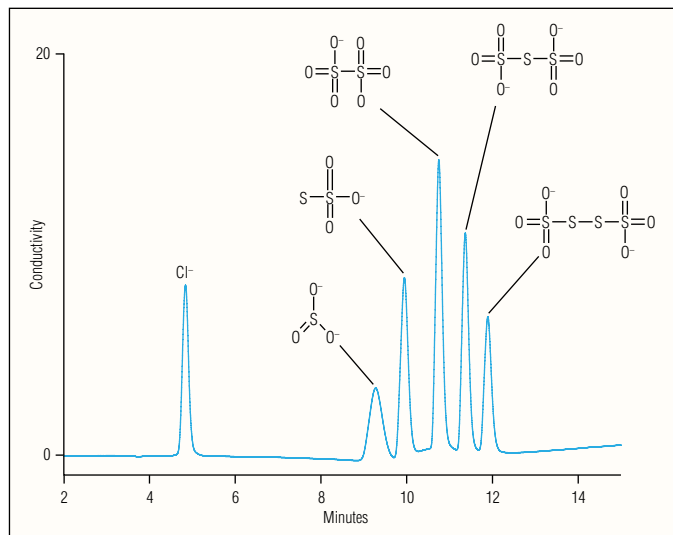


Figure 5. Polythionates on the prototype column.

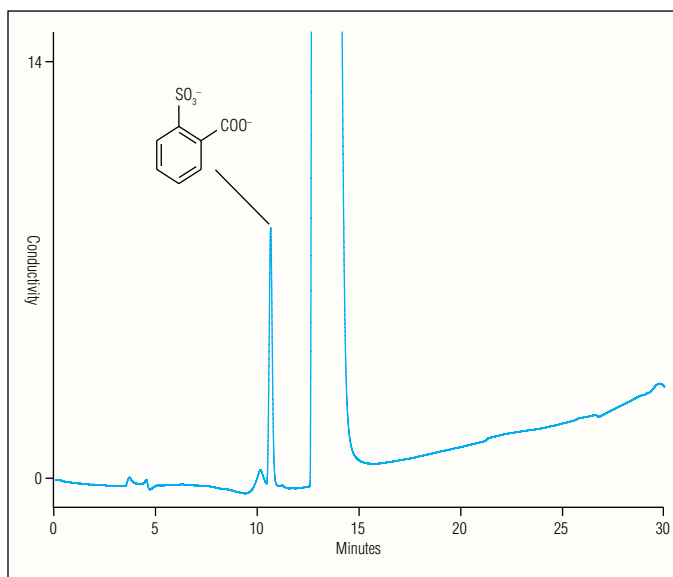


Figure 6. Impurity in CAS 224317-98-0 on the prototype column.

While all three columns used in this study are based on a surface sulfonated wide pore substrate, the stationary chemistry of each of the three columns is distinct:

The AS11-HC stationary phase utilizes a latex prepared with a glycidoxystyrene monomer which has been quaternized with methyl diethanolamine.

The AS21 stationary phase utilizes a much more hydrophilic amine-diepoxide hyperbranched condensation polymer based on methyl amine and diol-diglycidylether.

The prototype stationary phase utilizes an even more hydrophilic amine-diepoxide hyperbranched condensation polymer based on 2,2 - (ethylenedioxy)bis(ethylamine) and a diol-diglycidylether.

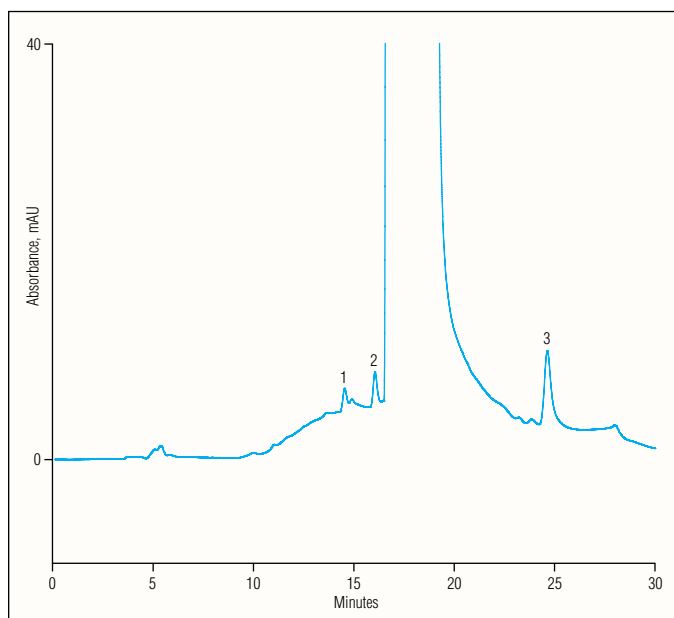


Figure 7. Unknown impurities (peaks 1–3) in Acid Yellow 23 on the prototype column.

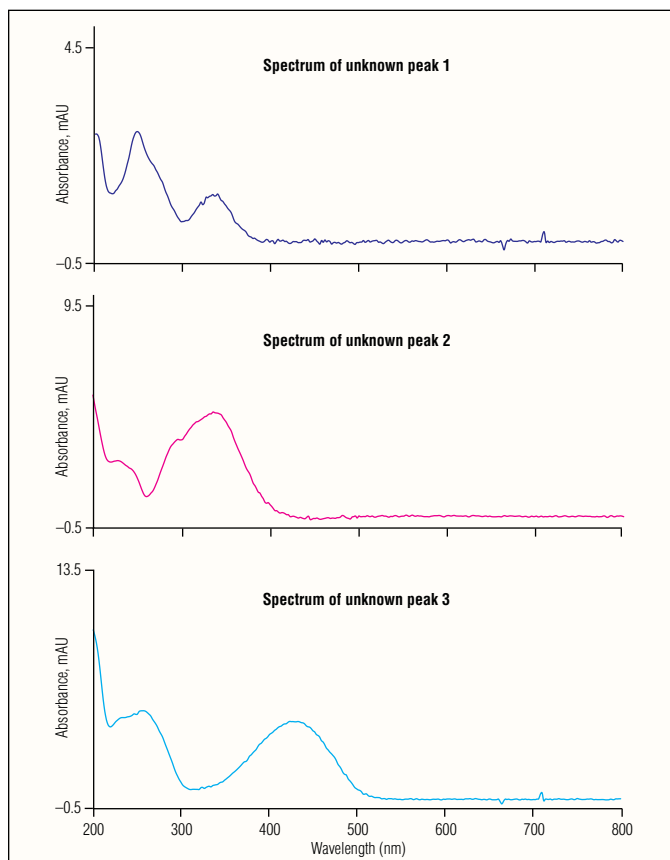


Figure 8. Spectra of unknown peaks (see Figure 7) in Acid Yellow 23.

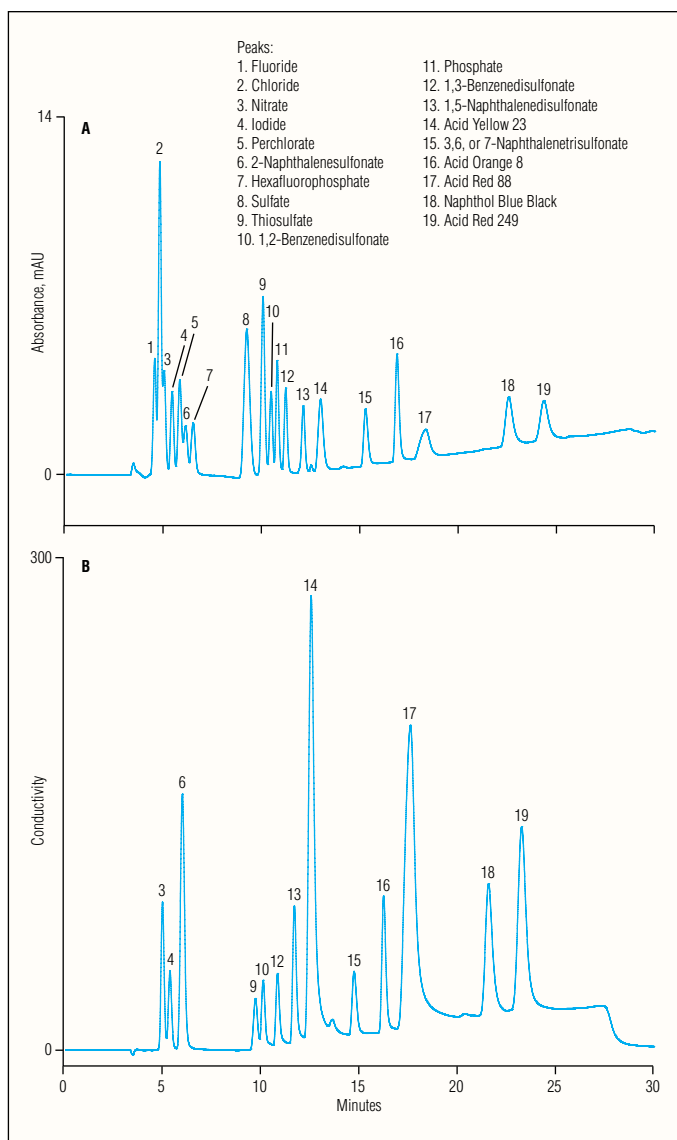


Figure 9. Anions and dyes on the prototype column with a sodium hydroxide gradient in 20% acetonitrile using A) conductivity detection and B) UV detection.

## STRUCTURES

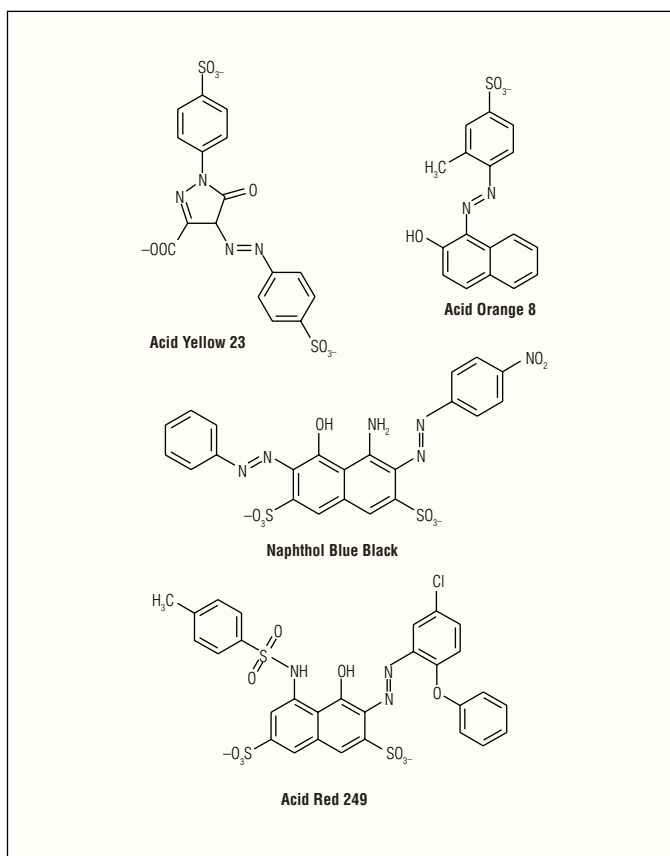


Figure 10. Structures of sulfonated dyes.

## SUMMARY

The IonPac AS11-HC column is referred to as a medium to low capacity stationary phase. It is incapable of eluting iodide, perchlorate, thiosulfate, and hexafluorophosphate under operating conditions. Furthermore, nearly all the aromatic sulfonates would not elute. All these solutes are readily eluted from the "ultralow hydrophobicity" AS21 column. The prototype column studied in this work has extended capability, eluting Acid Yellow 23, polythionates, and metal-cyano complexes without the aid of an organic modifier. Running the sodium hydroxide gradient in acetonitrile permits the elution of a number of multiply charged sulfonated dyes. The prototype column does compromise separations of early eluting monovalent species (fluoride through hexafluoro-phosphate eluting in a narrow time range). This is a trade-off, permitting a wider selectivity range. The prototype column studied in this work will make an excellent screening column as well as a useful tool for a number of dye separation applications.

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