# Syntheses of gels for high-efficiency metal/semiconductor separation of SWCNTs

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Gel column chromatography method has shown a substantial potential for scalable metal/semiconductor (M/S) separation and further single-chirality separation of single-wall carbon nanotubes (SWCNTs) [1]. However, the role of the gel is not well known. To get higher separation efficiency, more efforts should be made to clarify the role and to develop novel gels. Commercially available Sephacryl gel (GE Healthcare) has been often used for gel column chromatography. However, Sephacryl gel is not designed for SWCNT separation but is designed for size exclusion chromatography. This suggests the current gel might not be the best gel for SWCNT separation. In the gel column chromatography method, the attractive interaction between semiconducting SWCNTs and gel polymer plays important role. Nevertheless, only one selection of Sephacryl gel limits the possible separation of many types of single-chirality SWCNTs.

In this study, as the first step of gel development, we have synthesized dextran-based gels containing different concentrations of allyl dextran as analogues of Sephacryl. Our research showed that more semiconducting (s-) SWCNTs adsorbed in the gels as the ratio of allyl dextran increased, indicating the increase of the adsorption site for s-SWCNTs (Fig. 1). Now we can adjust the chemical structure of the gel to control the interaction between SDS-wrapped SWCNT and the gel. Surprisingly, our best gel adsorbed 15 times more s-HiPco SWCNTs (diameter, 1.0±0.3 nm) than Sephacryl S-200 did. This means the new gel can separate 15 times more s-SWCNTs without changing column size. This enhancement in the separation efficiency can reduce the cost of industrial scale M/S separation of SWCNTs. Furthermore, all the synthesized gels showed chirality selectivity for the overloading of SWCNT, demonstrating a potential for the single-chirality separation. The newly developed gels will be powerful for the industrial-scale M/S and single-chirality separation of SWCNTs。

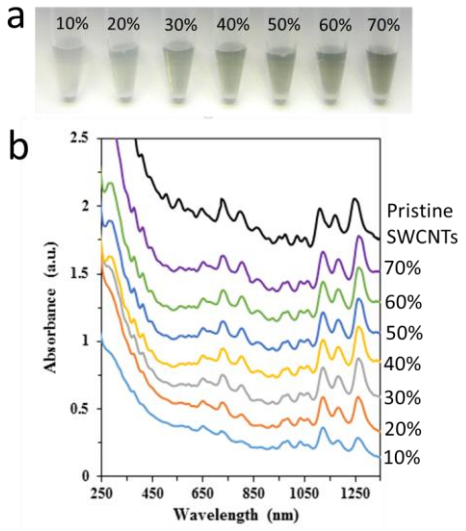


**Fig.1.** The photos of S-SWCNTs separated by gels that contain different concentrations of allyl-dextran (a). The corresponding adsorption spectra of the separated S-SWCNTs (b).

[1] H. Liu et al. Nat. Commun **2**, 309 (2011).