**Smartphone-Enabled Mesoporous Silica Nanotube Chemosensors for Quick and Selective Mercury Detection in Water and Cosmetics**

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**1. Materials**

For the experimental procedures, all chemicals were employed as received without any additional purification steps. Milli-Q water served as the solvent for all experimental setups. The following materials were sourced: Multiwall carbon nanotubes (MWCNTs, Sigma-Aldrich, UK), cetyltrimethylammonium bromide (CTAB, Sigma-Aldrich, USA), Brij 58 (Sigma-Aldrich, UK), and tetraethyl orthosilicate (TEOS, Sigma-Aldrich, UK). The optical probe utilized was N,N,N,N′-Tetramethyl-4,4′-diaminobenzophenone. Buffer solutions across a pH range of 1–6 were prepared using KCl-HCl (0.2 M) and CH3COOH-CH3COONa (0.1 M). For adjusting the pH within the 7–12 range, 4-(2-hydroxyethyl)-1-piperazineethanesulfonic acid (HEPES) and disodium hydrogen phosphate (0.1 M) were used. These materials were integral to the development and testing of the mesoporous silica nanotube-based chemo-sensors for mercury ion detection.

**2. Instruments**

The Shimadzu 2600 UV/Vis spectrophotometer was used to measure the absorbance of the HDN chromophore-based nano-conjugate material and other solid-state test samples. The (X, PERT-PRO-PANalytical, Netherlands) device was employed to generate low-angle X-ray diffraction (XRD) patterns. The Quantachrome Autosorb system was utilized to evaluate adsorption/desorption isotherms at 77K. The Zeiss Leo Supra55 Microscope was used to obtain images of silica nanoparticles and all materials utilizing the field emission scanning electron microscopy (FESEM) technique. The JEOL-100S device (Japan) was used for imaging silica nanoparticles before and after modification through transmission electron microscopy (TEM).