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(81) **Designated States** (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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[Continued on next page]

- (54) Title:** FRACTIONATION OF DE-ASPHALTED OIL OF VACUUM RESID USING PREPARATIVE HIGH PERFORMANCE LIQUID CHROMATOGRAPHIC SEPARATIONS

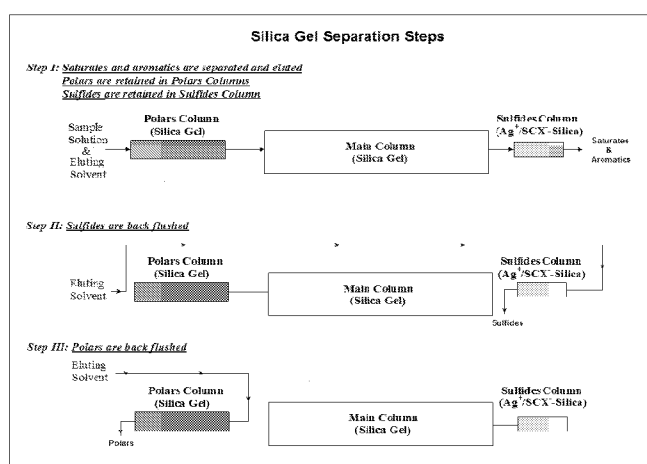


Figure 1: A Schematic Diagram of Silica Gel Separation Technique Steps

(57) Abstract: Two quantitative HPLC separation techniques to fractionate de-asphalted oils (DAOs) into seven classes of compounds (saturates, 1-, 2-, 3-, & 4⁺-ring-aromatics, sulfides, and polars). In the first step, named as Silica Gel Separation (SGS), the DAO of a petroleum vacuum resid is separated into four classes of compounds, namely saturates, aromatics, and sulfides utilizing two silica gel packed stainless steel columns and a silver nitrate loaded strong-cation-exchange column. In the second step, named as Aromatic Ring Class (ARC) separation, the aromatic fraction obtained in SGS (described above) is further fractionated at very low temperature (about -40 degrees centigrade) into 4 fractions, namely 1-ring, 2-ring, 3-ring, and 4⁺-ring aromatics utilizing a [3-(2,4-dinitroamino-)propyl]-silica gel (DNAP-silica) column.



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