
SHALE GAS POTENTIAL OF LOWER CRETACEOUS SEMBAR FORMATION IN MIDDLE AND LOWER INDUS BASIN, PAKISTAN

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ABSTRACT

Natural gas production from tight shale formations, known as “shale gas”, has become an important source of natural gas in the world due to technological advances and rapid increases in natural gas prices as a result of significant supply and demand pressures. Pakistan is facing big challenges in meeting its ever growing energy needs due to expanding population and economic growth. It is necessary to exploit unconventional energy resources along with conventional ones to meet the country energy requirement.

Here, we investigate shale gas potential of Lower Cretaceous Sembar Formation within a large area of Middle and Lower Indus Basin. The study includes the organic richness, hydrocarbon generative potential, shale thickness and distribution, subsurface depth of studied interval, maturity, volume of hydrocarbon generated and retained per section and reservoir characteristics of Sembar shales.

Geochemical data show that the TOC of the formation ranges from 0.55 wt. % to 9.48 wt. % with present day generation potential of 0.14 – 18.69 mg HC/g rock. The average TOC of immature samples is 1.0 wt.% with generation potential of 2.88 mg HC/g rock and hydrogen index (HI) of 240 mg HC/g TOC (type III & II/III).

Gross thickness of the formation ranges from less than 50m to more than 1000m with an average of 300m in the study area. Subsurface depth (top of the formation) varies between 1000 to 5000m in platforms to foredeeps areas. Overburden thickness, geothermal gradient, Tmax and Vitrinite Reflectance data place the formation in oil, wet and dry gas windows at the depths of 2500m, 3200m and 3400m respectively. Based on original generation potential, and average source rock thickness, volume of generated hydrocarbon (gas equivalent) is 242 bcf/section. By taking expulsion (50% of the generated volume) in to account and conversion of retained oil into gas through secondary cracking, the retained volume is 103 bcf/section. Average porosity of the formation at reservoir level (3400- 4000m) is 6.0%. Mineralogically, the formation is composed an average of 42% quartz, 47% clay, 3% calcite and 1% pyrite. Depth for shale gas exploitation in platform areas is about 3500m, where as in foldbelt regions, it varies between 1000 to 3000m.