

**EXECUTIVE SUMMARY OF THE FINDINGS OF UGC-  
SUPPORT**

**MINOR RESEARCH PROJECT**

**ENTITLED**

**STUDIES ON VARIOUS TECHNIQUES OF WATER  
SHUT OFF FOR IMPROVING OIL PRODUCTION OF  
THE OIL FIELDS OF UPPER ASSAM BASIN**



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## EVECUTIVE SUMMARY

The researchers worldwide acknowledge the need to address the high water cut problems of oil fields by undertaking timely and appropriate water shut off measures. In the early days of hydrocarbon industry, the lack of appropriate water shut off measures has led operators to abandon the wells with water production problems. Production behaviour studies of porous media with water production problems have always been an area of concern for the Petroleum Industry worldwide. The findings of the project have relevance to propose to facilitate further extensive literature survey, to conduct more laboratory experiments with porous media to find out the appropriate measure that may be useful for production well WOR reduction.

The findings of the project put emphasis both on the mechanical and chemical water shut off techniques. Findings of the literature surveys reveal that mechanical water shut off measures are more popularly used worldwide. Recent studies reveal that gel treatment applications are getting attention worldwide for production well WOR production. Several researchers suggest that invocation of gel treatment strategies may significantly reduce the WOR and oil production get revitalized. Although, mechanical methods of water shut off are popularly applied in the porous media of Upper Assam basin; there is huge potential for the applications of polymer gel techniques in the matured oil fields which produces higher water cut. Findings of the laboratory works carried out during the project work project that by utilizing chromium crosslinked polyacrylamide gel technology, it is possible to reduce the water production from porous media. The results of many successful gel treatment jobs have been reported in the literature which describe the effectiveness of the gel treatments conducted to drop down the water production volume, to reduce the lifting costs associated with the lower fluid volume, to reduce stress on the lifting equipment, lowering of well servicing cost and finally to extend the economic life of high water cut wells. Researcher like Reynolds et al [2000] suggest several criteria for selecting candidate wells for gel treatment that include wells already shut-in or near the end of their economic life, significant remaining mobile oil in place, high water oil ratio, high producing fluid level, declining oil and flat water production, wells



associated with active natural water drive, high-permeability contrast between oil and water saturated rock. Studies reveal that gel treatments do more aggressive types of profile modification as it can block certain porous features associated with the porous media. In a very active manner, polymeric gel is able to divert fluid flow from areas of high permeability to lower permeability.

However, gel instability results in the collapse of the gel structure and usually occurs due to improper crosslinking. Polymer hydrolysis may play important role in the successful formulation of the polymer gel. It was found that, gel strength initially develops and then gradually decreases to a water thin solution. This involves the breaking of chemical bonds, with the resulting loss of molecular weight and structure. Probable causes are oxygen contamination, free radical generation etc. It is therefore assumed that aging effect is present in the PAM gels.

Laboratory works suggest that the gel time and strength can be controlled by adjusting the polymer and crosslinker concentration. Rate of gelation usually increases with increasing temperature. Dilute solution of PHPA degrades when stored for a prolonged period. This aging behaviour need to be prevented to place the gel for successful water shut off operations.

Polymer retention/adsorption in the rock occurs in the porous media which helps in the blocking of flow channels. Gelation time can be controlled depending upon the gel composition and environmental condition.

Research works worldwide reveal that organically cross-linked polymers are known to have a higher thermal stability than the inorganic one. Organic materials usually retard gelation kinetic but gel strength remains at a considerable level. From the laboratory experiments conducted, it is found that the porosity and permeability of the porous media are getting reduced due to the placement of the gels.

Finally, the proposed project work suggest that although, mechanical methods of water shut off are popularly applied in the porous media of Upper Assam basin; there is huge potential for the applications of polymer gel techniques in the matured oil fields which produces higher water cut.

