CHAPTER ONE

INTRODUCTION:

1-1 INTRODUCTION

Hydraulic fracturing is a well stimulation method where a fluid is pumped into the rock to create fractures that called hydraulic fracture. These fractures are intended to function as high-conductivity fluid pathways enabling increased productivity of a well

In a hydraulic fracture is using a pressure to cause hydraulic fracture, caused by injecting of a fracturing fluid into a selected rock formation need to stimulate. Fracturing fluid is pumped toward the selected formation need to stimulate using a pressure that exceeds the formation fracture pressure.

Hydraulic fracturing deals with injection high viscosity fluid called (fracturing fluid), down to the wellbore at a flow rate, which is greater than the fluid leak-off rate into the both sides of the hydraulic fracture so that it builds-up pressure to overcome the tensile strength of the formation rock and create an effective communication between the stimulated formation and the wellbore. The effect is the initiation and propagation of crack or fractures on a plane perpendicular on the least principal stress.

The success of hydraulic fracturing job depends on a large extent on the hydraulic fracture dimensions: half length, width and height of the hydraulic fractures, as well as the proppants, fracturing fluids, treatment schedule etc. The mechanical properties that control fracture geometry are Young's model, which is primary control of the fracture width, where the fracture height is primarily controlled by minimum closure stress contrasts.

After fracturing the reservoir, a propping agent which is non compressible solid particle material, such as sand or ceramic beads that are added to the

fracturing fluid to form a slurry that is pumped into the new generated fracture in the formation, in order to prevent the fracture from fully closing again when the pumping pressure is released. This causes both sides or walls of the hydraulic fracture to compress onto the proppant, i.e. the proppant is trapped between the fractures faces, generating a high-permeable path way or high conductivity, that allows the oil and/ or natural gas to flow into the well and then to the surface. The proppant transportability of a base fluid depends on the type of additives which control the viscosity, added to the water base.

The main principal physical properties of the proppants affecting the hydraulic fractures conductivity are proppant grain size distribution, strength, roundness, quantities of fines (proppant), density, and sphericity.

During hydraulic fracturing job, engineers need to maintain a constant rate of fracturing fluid injection.

Technically, screen out mean that the condition where continued injection of hydraulic fluid to the hydraulic fracture need pressures in excess of the safe limit of the wellbore or wellhead equipment. Operationally, screen out causes a severe confusion in fracturing job in wells and often requires stoppage of fracturing fluid pumping and cleaning of the wellbore before resumption of fracturing job. Screen out is an operational issue and does not necessarily mean damage to well productivity. Actually, many wells end up being active producers after a screen out happen. Screen out consumes time and money during the hydraulic fracture job, for that problem, the operator needs to avoid the parameters that may led to the screen out.

The concentrated proppant slurry causes plugging the hydraulic fracture, and preventing additional growth of the hydraulic fracture length. Additional

continues of pumping of the proppant with the fluid slurry into the formation after the screen out happen, causes the hydraulic fracture to balloon. For that the fracture going to grow in width rather than length, and large concentrations of proppant per surface area will occur in the fracture.

Tip Screen Out (TSO) is a hydraulic fracture technique which can applied to the high permeability reservoir, in that case the main objective of the hydraulic fracturing is not to increase the formation production of the formation that is has high permeability, but to prevent the sand or solid particles movement (which is unconsolidated or poorly consolidated reservoir and to prevent and / or control the production of sand), by controlling or reducing the wellbore pressure gradient.

The objectives of this study are to investigate the behavior of the ceramic proppant during passing through the hydraulic fractures and study the conditions effecting or leading to the bridging or screen out inside the hydraulic fracture such as proppant concentration, value of β (the ratio between the fracture width to proppant diameter) and the effect of fracture wall roughness. For that the apparatus was build and designed to meet the real hydraulic fracture through changing the width of the fracture and the fracture wall roughness. The apparatus designed to meet the fracture shape by using irregular tube represent the hydraulic fracture wall and using ceramic proppant size type 20/40.

The results gotten can used by hydraulic fracture engineer to avoid the screen out occurs by controlling the proppant concentration and size. Also can design the tip screen out for the high permeability formation to control sand production and to reduce fines migration.

The apparatus was build vertically to use the gravity to force the suspension flow through the fracture, in order to avoid the settling of the proppant after entering the fracture during the experiments because of gravity if the direction of the suspension flow in horizontal direction, as a real condition during hydraulic fracturing job