

Chapter 2

Theoretical and Background

2.1. Cement micro-cracks definition

Cement micro cracks are the tiny channels in the cement structure, which happened according to bad cement slurry design or well condition effect, and mud cake. Cement micro cracks are problems faced cementing engineers in oil and gas well cementing from many years ago, and these problems need to be solved because of the other big problems which they make such as gas migration and water migration, and those cause damage in the well, my be they cause well blow out, and as known that the main purpose of cementing is to achieve zonal isolation so the cementing job must be good and clear from cracks (lockyear, 1990).

2.2. Cement micro-cracks reasons

A lot of reasons cause cements micro-cracks problems those reasons generally are:

The inherent characteristics of cement: If the characteristics of the cement is not according to cement standers like (API) standers or (ASTM) standers it will cause micro cracks problems and other problems also, these characteristic are the mechanical characteristics such as compressive strength, hardness and consistency, the minimum compressive strength after 8 hour must be 500psi and 1500 psi after 72 hours according to (API 10A).if the compressive strength not as that stander that will cause the problems.

The existence of the mud cake: Existence of the mud cake also cause cement micro-cracks, because of the two difference structure between cement and mud, also enter of some mud into cement slurry while cementing job, which leaves inner micro channel when cement slurry begins to be solid.

Grid structure strength formed in the early stage is low: This reason happened according of bad cementing or bad design, so the compressive strength low, and cannot bear the upper hydrostatic pressure, and this cause cement cracking (AL-Buraik, et al., 1998).

2.3. Well problem due to cement micro-cracks

Well problems happened due to cement cracks are: gas migration and water migration from gas and water zones, also poor cementing job which cause casing movement and other problems. If there are water and gas zones, they must be isolated very well, gas and water migration happened when any they meet any crack in the cement ring and this cause a real problems such as:

1. Enter of un need gas and water into well bore and cause damage.
2. Out of toxic gas and make worker life in danger.
3. Corrosion of casing with water, water may content a lot of slot or other chemical content (Sutton, et al., 1992).

2.4. Solutions of cement micro-cracks

Solution of the cement micro-cracks problems have been start early , every company at oil field cement operation have special solution to this case also they have special chemical additives . Here are some examples of solution:

1. Good pre cementing job completion and cementing design:

Engineers observe that a good pre cementing job completion also stopped cement cracking such as centralizing the casing and use scraper to scrap mud cake and also they suggested making cementing design better by improving cement hydration and using multi stage cement.

2. Using fiber materials: Using of anti cracks additives such as fiber, cellulosic and geliconian materials, those anti crack materials have ability to reduce and stop micro cracks also to improve cement hydration and minimize permeability (Nelson, 1990).

2.5. Literature review

Using of anti cracks additives such as fiber, cellulosic and geliconian materials, those anti crack materials have ability to reduce and stop micro cracks also to improve

cement hydration and minimize permeability. ASOTA institute in Vienna in (2001) used fiber as an (MCP) Micro crack preventer. Table (2.1):

Table (2.1): show fiber properties which ASOTA used in 2001.

Subject	Properties
Fiber cross section	Round
Fiber diameter(mm)	34
Strength(N/mm ²)	>275
Elongation (%)	>80
Fiber proportion(million/kg)	89
Cut length (mm)	14
Fiber distribution	Excellent
Density(g/cm ³)	0.91

Recommended quantities to use 0.9 kg ASOTA R MCP per 1m³ concrete.

The result happened by using fiber are:

1. Segregation is reduced.
2. Hydration is improved.
3. Plastic shrinking cracking is reduced.
4. Impact and abrasion resistance is increased.
5. Permeability is reduced.
6. Corrosion is slowed.
7. Maximize toughness index.
8. Lower cost.

Also there is another study suggest the used of human hair to improve the micro-cracks problem, because it have fiber content. The results show that human hair fiber is effective in reducing the micro-cracks by remarkable percentage up to 92%.

2.6. Using of mesquite wood powder

using of mesquite powder to see the effect of it in reducing or stopping the cement micro-cracks are the main objective of our research, and the reasons make us to suggest it is because of its component, it has celluloid and geliconian component, and as we know from literature views that the cellulosic and geliconian materials are an anti-crack agent we decided to add it to the cement slurry and make tests.

2.6.1. Macrobiotic classification, family and gender of mesquite:

Macrobiotic classification:

Procopius juliflora.

Family:

Lequminosae.

Sub family:

Mimosoidea.

Gender:

Procopius.

Mesquite is Para, tabulate crest and echinoderm tree. It height may be arrives 10meters.this tree grown in Mexico, Venezuela, Colombia and South west of USA. The color of the tree leg is lackcluster brown, and the tree leg by longitudinal fracture (Edward and Dennis, 1994).



Figure (2.1): typical mesquite tree

Table (2.2): chemical analysis of mesquite wood powder (Edward et.al., 1994)

Chemical component	Percentage, (%)
Fiber	20.8
Nitrogen free extract	50
Ash	7.7
Phosphorus	0.2
Calcium	1.5
Magnesium	0.5
Crud protein	21.4

2.6.2. Mesquite in Sudan (History):

Mesquite (*P. Juliflora*) was introduced into Sudan in (1917) from South Africa and Egypt and planted in Khartoum. The success attained in establishment of the tree and its abilities to tolerate drought and fix sand dunes provided the impetus for introduction of the tree into various agro ecologies with emphasis on dry areas, In (1938) the plant was introduced into Sinner, EL foug (central Sudan), Elghaba, (northern Sudan), Sinkat, ELgalabat, Port Sudan (eastern Sudan), Kordofan and Darfur (western Sudan) Late in (1947), until (2003) mesquite trees covered most part of Sudan (El tayeb, 2003).

2.6.3. Benefits and Uses of mesquite:

1. This tree is bearing the most drought degree.
2. Uses for garnish in general gardens.
3. As pack stops, green waist bands and sand fixity.
4. The antlers used as a good animal's food.
5. The wood used in carpentry and it's a source of fuel and coal.
6. The flowers used to produce the honey(Edward, et al.,1994)

2.6.4. Problems Caused By Mesquite:

1. Consume the soil that means it is strong competitor for the others plants.
2. Quick in pervasion that means take a wide area.
3. Gutting the farms.
4. Pinhole the water flow lines in cities.

2.6.5. Fighting the Mesquite:

1. Mechanical method such as drilling (very expensive).
2. Chemical method, but this approach had ecological impact (pollution).
3. Biological methods.