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Calculating the Pore Volume Of The Block By Using The Triangular Mesh Method

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Abstract:- Polymer flooding has become an important means to improve oil recovery, but there are a lot of improvement in the control of the amount of polymer to the largest increase in the economic profit of the technology.For example, the calculation of the amount of polymer is one of the important parameters of block pore volume, the traditional method is the average porosity calculation of the whole block, the average effective thickness, pore volume of product area to calculate the block. But this is only the average value of the block. Actually well point in the block is not distributed evenly, the triangulation method can avoid flat error caused by traditional methods in the thickness of the grinding, reaction pore volume distribution characteristics within the block, which is conducive to the development stage of oilfield development program and the maximum increase economic benefits.

Key word:- *Polymer flooding pore volume triangular mesh method*

I. INTRODUCTION

Polymer flooding is to reservoir into some relative molecular mass of water solution of polymer solution, polymer in order to improve the water oil mobility ratio, adjust injection profile, enlarge the swept volume and improve oil recovery method.by increasing the injecting water viscosity and reduceing reservoir permeability of water phase, In the design of polymer flooding scheme, the choice of reasonable dosage of polymer is the key to the success or failure of the design scheme, which is related to the technical effect and economic benefit. The recovery ratio of polymer flooding is too low, which leads to the low utilization rate of polymer flooding, which will lead to the decrease of the utilization ratio of some polymers and the economic benefit of polymer flooding. According to previous studies, the pore volume, effective thickness and polymer concentration of polymer flooding blocks are the important parameters of injection polymer dosage. Therefore, the accurate calculation of reservoir pore volume is an indispensable part in the process of polymer flooding.The general calculation method of the current pore volume is the product of the block area, effective thickness and the average porosity of the block. It is calculated as: the effective thickness of the block effective thickness = block single well cumulative / blocks with a total number of wells; block of the average porosity calculation method for: accumulation of block average porosity = block single well porosity / blocks with a total well. But in fact, due to the current well point distribution is not uniform, irregular. In some areas, some well density is large, and some well point density is small. If the above method is used to calculate the pore volume, the error of the calculation of the pore volume can be caused, especially when the fine calculation of the pore volume is carried out. The pore volume calculated by this method is only a large average value, which does not reflect the distribution characteristics of the pore volume in the whole region.

Using the "triangle mesh method" to calculate the pore volume of the polymer flooding block, the pore volume of the block can be more accurate and more accurate. The method is in calculating the pore volume and thickness according to the table (subdivided channel and non channel and different thickness grades) and table sand body (class I table and class II table and gradient and independent) pore volume were calculated. And in the area of the calculation process using the following methods: (1) according to the different sedimentary unit of the actual trap sand body area after deducting the pointed out area, (2) the oil area of different thickness grades are further traps on the basis of similar sand bodies. the control area of the single well is determined by the triangulation method In the calculation process. The error caused by the thickness flattening algorithm is solved, which makes the calculation of the pore volume more reasonable in order to Provide more accurate calculation parameters for polymer flooding.

II. CALCULATION OF SINGLE WELL CONTROLLED PORE VOLUME

2.1 determination of pore volume parameters

The factors affecting thrvoir area, effective thickness of single well and the average porosity of single well. The factors affecting the calculation of single well contre calculation of single well controlled pore volume are the single well controlled reseolled pore volume are the single well controlled reservoir area, effective thickness of single well and the average porosity of single well.

2.2 Determination of single well control area

The area of the single well controlled area is 1 / 2 of the distance from the single well to the adjacent well, and the area of each well can be controlled with the well spacing. The area of single well control is small in the well point density, while the single well control area is large. According to this rule, the single well control area can be determined by using the triangulation method, and the triangle net is a series of triangles which are connected with each other in a straight line. Specific methods are as follows:

(1) determine the starting triangle

From the point of taking a little A, and then from the other points in the search from its closest point B as the starting point of the triangle of second points, and then from the point in the vicinity of the triangle to find the third fixed point C . The selection rule is the angle C is the largest of the corners (Figure 1). The cosine theorem is used to calculate the angle C:

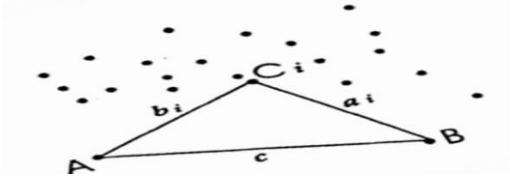

Fig.1 Discriminant method using cosine values

$$\cos \angle C_i = \frac{a_i^2 + b_i^2 - c^2}{2 a_i b_i}$$

Where. $a_i = BC_i; b_i = AC_i; c = AB$

(2) expansion of the initial triangle

The three sides of the initial triangle are expanded in turn, and all the discrete points in the point set form a triangular mesh before all the edges of the triangles are extended. The selection principle with the Bighorn is to ensure that the established triangle does not cross; At the same time，establishing a triangle before the preservation to judge whether it is already established in the triangle to ensure the establishment of a triangle in the triangle.

(3) single well control area

According to the established after the triangulation location coordinates, each triangle midpoint of the division of the region together is the single well control area (Figure 2). In fact, the control area of a single well is the sum of the area of an arbitrary quadrilateral (depending on the number of triangles connected to the well point). Each quadrilateral is a region which is divided by the midpoint of the triangle:

$$Ai = \sqrt{(p-a)(p-b)(p-c)(p-d)adcd \cos^2 \alpha}$$

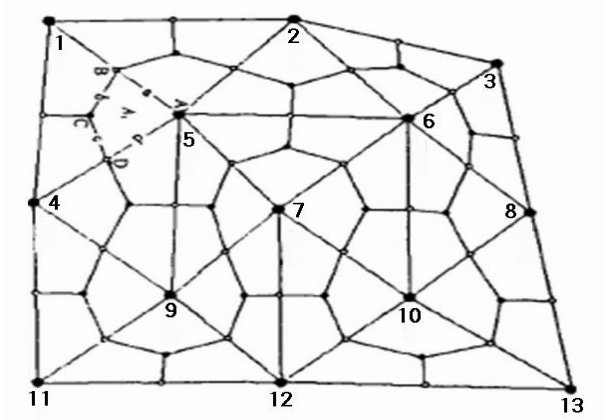

Fig.2 Using the triangulation method to calculate a single-well-controlling area

Where. Ai is a quadrilateral area； a, b, c and d is respectively with quadrilateral ；

$\angle A$、 $\angle B$、 $\angle C$、 $\angle D$ are four corners of the quadrilateral

$$p = \frac{1}{2}(a + b + c + d)$$

$$\alpha = \frac{1}{2}(\angle A + \angle C) = \frac{1}{2}(\angle B + \angle D)$$

The single well control area is:

$$A = \sum_{i=1}^{n} A_i$$

Where A is a single well control area; for a quadrilateral area; n is the number of triangles at a certain point.

2.3 Determination of effective thickness average of single well

The area that each well can control varies with the well spacing, and the thickness of the reservoir is represented by the thickness of the reservoir.

2.4 Determination of average porosity of single well

We can use the analysis of sample data or log data to calculate the average value of the sample data in the effective thickness range of the reservoir. The formula for calculating the average porosity of the single well is calculated by the thickness balance method:

$$\bar{\phi} = \frac{\sum_{i-1}^{n} \phi_i h_i}{\sum_{i-1}^{n} h_i}$$

Where. $\bar{\phi}$ —· Average porosity, decimal：

ϕ_i —· Each rock sample analysis porosity, decimal

h_i —· Control the thickness of each rock sample， m

n —· Sample number。

2.5 Calculation of reservoir pore volume in single well control

Using the above method to determine the parameters of the pore volume, the pore volume corresponding to each well in the reservoir can be calculated by using the formula. Pore volume = single well controlled area * single well effective thickness * single well average porosity . The single well controlled pore volume is equal to the sum of the pore volume of each sedimentary unit in the well, and the total pore volume is equal to the sum of the pore volume of all the wells in the well.

III. CONCLUSIONS

1) according to the sedimentary unit and the specific type of sand body, the method of triangle net is used to determine the control area of the single well in the process of geological reserves calculation so that the control area of the single well is more reasonable. The method solves the error caused by the "single well control area, the total well number" and "the thickness of the flat" algorithm, which makes the calculation of the pore volume more reasonable.

2) using fine computing method of pore volume, according to the static data of oilfield development can be calculated pore volume of single well in different types of sand body to realize the purpose of fine pore volume calculation of sedimentary units and specific types of sand body The distribution of pore volume is more explicit, which is beneficial to the calculation of the amount of polymer. At the same time to improve the recovery rate, and better control costs avoids waste.

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