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BIOLOGICAL SCIENCES

FIRST RECORD OF *POLYMIXIA NOBILIS* LOWE, 1836 IN BENIN CONTINENTAL SHELF (GULF OF GUINEA)

Sohou Z.,
Okpeitcha O.
Institut de Recherches Halieutiques et Océanologiques du Bénin / Centre Béninois de la Recherche Scientifique et de l'Innovation (IRHOB/CBRSI)
Département de Zoologie, Faculté des Sciences Techniques (FAST/UAC)
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Abstract
Two specimens of the fish species stout beardfish (Polymixia nobilis) were collected from the fishermen catch at Cotonou Port in Benin. The current report represents the first record of Polymixia nobilis in Benin continental shelf. Nethertheless they found it in Sierra Leone. FAO not yet mentioned in Gulf Of Guinea biodiversity till to now. From this time to now no more specimen was collected.

Keywords: *New record, Benin, Continental shelf, Polymixia nobilis*

Introduction

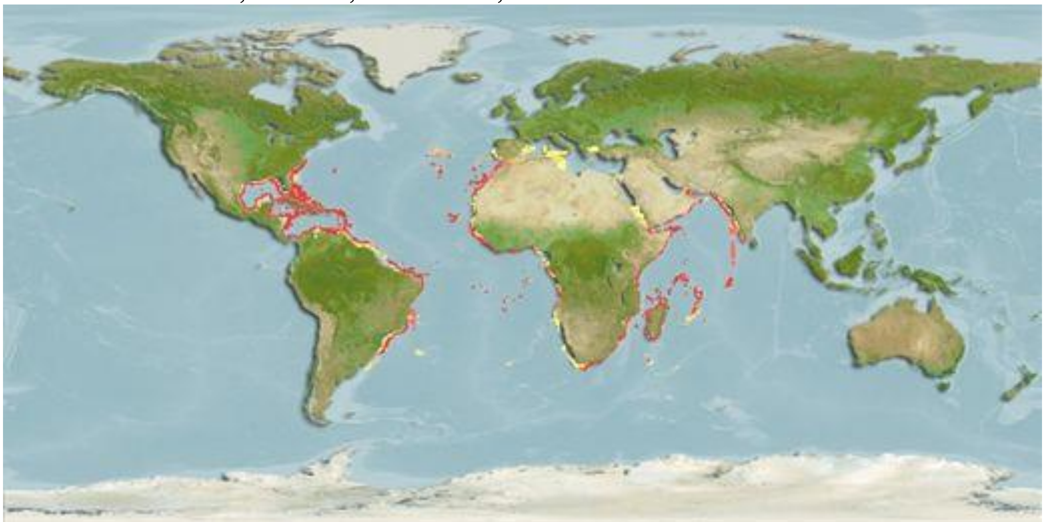
The stout beardfish is a deep water fish of the Eastern and Western Atlantc ocean, with a geographical range that extends from West Indies, Saba Bank, Leeward Islands, off northern coast of Cuba and west of the Bahamas; reported to occur in the northern coast of South America, as far north as 43.67°N (WoRMS taxon detail). The specie was not documented in all countries in Gulf Of Guinea by FAO (Schneider 1990) and particularly during the survey in FAO zone 34.

The capture of a specimen of *Polymixia nobilis,* a rare species in the eastern Atlantic waters north of the Canary and Madeira Islands, is reported as the first record in the vicinity of the Strait of Gibraltar (Farias & *al.* 2007).

To date, stout beardfish has been confirmed to occur in many countries. It's distributed across the Atlantic Ocean. In the eastern central Atlantic (ECA) it is known from the Corner Rise seamount, the Azores, Madeira, Greater Meteor seamount, Seine and Sedlo seamount, the Canary Islands, Cape Verde and St. Helena Islands. It has a disjunct distribution in the ECA and is found around oceanic islands. In the western Atlantic it is known from Florida, Bermuda, the Bahamas, Cuba and the eastern and northern Gulf of Mexico, Lesser Antilles and from Panama to the French Guiana. It is found from 70-800 m depth, but more commonly between 360-540 m (Moore 2002).

According to red list, Native countries are: Anguilla; Antigua and Barbuda; Aruba; Bahamas; Barbados; Bermuda; Bonaire, Sint Eustatius and Saba; Brazil; Cape Verde; Colombia; Cuba; Curaçao; Dominica; Dominican Republic; Grenada; Guadeloupe; Guyana; Haiti; Martinique; Mexico; Montserrat; Morocco; Panama; Portugal (Azores, Madeira, Selvagens); Puerto Rico; Saint Barthélemy; Saint Helena, Ascension and Tristan da Cunha (Saint Helena (main island)); Saint Kitts and Nevis; Saint Lucia; Saint Martin (French part); Saint Vincent and the Grenadines; Sierra Leone; Sint Maarten (Dutch part); Spain (Canary Is.); Suriname; Trinidad and Tobago; Turks and Caicos Islands; United States; Venezuela, Bolivarian Republic of; Virgin Islands, British; Virgin Islands, U.S.; Western Sahara.

FAO Native region are: Atlantic – western central; Atlantic – southeast; Atlantic – eastern central; Atlantic – northeast; Atlantic – northwest (map N°1).



Note: Distribution range colors indicate degree of suitability of habitat which can be interpreted as probabilities of occurrence.

Table 1

Legend

Relative probabilities of occurrence 0.80 - 1.00 0.60 - 0.79 0.40 - 0.59 0.20 - 0.39 0.01 - 0.19	Explore native range map Explore suitable habitat map Explore point map Show mapping parameters Create your own map	**More species data:** List of countries List of FAO areas List of ecosystems

Distribution maps for *Polymixia nobilis* (Stout beardfish), with modelled year 2100 native range map based on IPCC A2 emissions scenario.
Source: www.aquamaps.org, version of Aug. 2013. Web.

Description

The bathydemersal species is usually found on semi-hard and soft bottoms on the continental shelves and slopes (Fock and *al.* 2002). It is found from 70-800 m depth (Moore 2002), but more commonly from 360-540 m. It is associated with a variety of deep-water structures, such as seamounts in the Azores (Pakhorukov 2008), and flat hard-bottom habitat off the coast of the eastern USA characterized by carbonate bedrock with little to no vertical relief, and patchy cover of small scleractinian and stylasterid corals (Wieber 2008) though it is not a dominant component of the species assemblage in terms of numbers or biomass in these habitats.

Diagnosis: body deep and compressed, deepest at level of dorsal fin origin (depth nearly one-third of total length). Eye large; snout short and rounded; dorsal profile of head rounded; snout projecting beyond lower jaw; maxilla very broad posteriorly and extending backward beyond eye; mouth large, horizontal; small teeth in villiform bands in both jaws, teeth also present on vomer and palatines; margin of preopercle weakly serrated; a pair of long chin barbels inserted well behind symphysis of lower jaw. Gillrakers 3 on upper, and 8 on lower branch of first gill arch. Dorsal fin with 4-6 spines graduated in size and 30-38 soft rays, the anterior ones very long, forming an elevated lobe; anal fin with 3 or 4 short spines and 16-18 soft rays, beginning below the posterior portion of dorsal fin; pectoral fins with 1 spine and 6 soft rays; caudal fin forked. Body covered with large, ctenoid scales; head scaled, except on the preopercle; scales on top of head extending forward almost to nostrils; lateral line scales 45-54. Colour: greyish to greenish, the head darker; lobes of dorsal, anal and caudal fins marginate with black. Size: to 35 cm SL, usually 20-25 cm.

Relevant biological parameters (reproduction, growth and feeding habits) were recently collected for this species with the expressed aim of allowing the future implementation of regulatory measures for the sustainability of the fisheries and conservation of this species in the Canary Islands (Garcia-Mederos *et al.* 2010).

In European waters *Polymixia nobilis* occurs frequently in the Canary Islands (Franquet and Brito 1995, Brito *et al.* 2002, García-Mederos *et al.* 2010). Delgado (2007) indicates the species to occur frequently off Madeira, Porto Santo and the Desertas islands. In survey cruises off the Azores, Menezes (2003) found the species to be rare.

Elsewhere in the Macaronesian area, the species is also common in seamounts, islets and islands off the Cape Verde archipelago (Menezes *et al.* 2004). The populations of *P. nobilis* in the area are subject to small scale exploitation, in a context of multispecies fisheries using hook-and-line and bottom longlines.

Material and Methods

Polymixia nobilis were with the fishmonger in fishing harbor during the follow up of biodiversity. According to them, the species were caught with a net. After observation, individuals are weighed and measured.

During inventory at the landing area with the fishmonger 21 November 2016 we find two specimen of stout beardfish. These specimen was preserved in 70% of alcohol (fig.2) at the Applied Ecological Laboratory of Abomey-Calavi University.

Results and Discussion

Systematics of the specie

Animalia (Kingdom), Chordata (Phylum), Vertebrata (Subphylum), Gnathostomata (Infraphylum), Osteichthyes (Parvphylum), Actinopterygii (Gigaclass), Actinopteri (Class), Teleostei (Subclass), Polymixiiformes (Order), Polymixiidae (Family), *Polymixia* (Genus), *Polymixia nobilis* (Species)

The capture of a specimen of Polymixia nobilis, a rare species in the eastern Atlantic waters central, is reported as the first record in Benin continental shelf. The specimens was caught by gill nets named "Tohounga" in local language. This engine usually caught a lot of diversity of fish.

The genus Polymixia (Lowe 1838) currently comprises ten marine species. Only two of them are present in the Atlantic Ocean, *Polymixia nobilis* (Lowe 1838) and *Polymixia lowei* (Günther 1859). The Atlantic beardfish (*P. nobilis*) is a bathydemersal marine fish occurring in tropical and subtropical waters over the outer continental shelf and slope, around islands and on seamountains at depths ranging from 100 to 770 m (Hureau 1984). It is usually found on soft and semi-hard bottoms. Two specimens of *P. nobilis* was identified at the Port jetty with artisanal fishermen.

Even in Fishbase a few information on the species available like missing range of Maturity size ; Maturity length L_m = 26.0, range 20 - ? cm Max length : 48.0 cm.

Estimate weight for given length = 13 cm correspond to 28.19 g ; The length to weight ratio is 0.42 at fishbase and in our case it is 0.45; these two values show that the growth is then linked to the environmental conditions.

***Photo1**: Two specimens collected in 2016*

***Photo 2**: One specimen*

Table 2

Meristic data of the specimens

Charcteritics	1	2
Lt	36	36
Lf	31	31
Ls	29	29
Eyes diameter	31	31
Barbel length	06	06
Eyes to Head length	11	11
Mouth to Eyes length	2.1	2.1
Weight	700g	695g
Body round	25cm	25cm

Morphometric characteristic

Dorsal spines (total): 5; Dorsal soft rays (total): 35; Anal spines: 4; Anal soft rays: 15; Vertebrae: 29. Dark brownish grey in color, silvery below; black blotch on distal part of anterior dorsal rays. Snout blunt, rounded, adipose. Hyoid barbels present.

Polymixia nobilis is found around oceanic islands and seamounts. It is targeted in some small-scale fisheries, but is mostly taken as incidental bycatch, particularly in seamount fisheries targeting *Beryx* spp. However, this is not a major threat. Therefore, it is listed as Least Concern

A single sighting is insufficient to indicate that a viable population of Atlantic humpback dolphins is present in Benin or the northern Gulf of Guinea. Indeed, the conservation status of the species remains very unclear throughout its range and previous concerns regarding low population sizes, high exposure to potential anthropogenic impacts and a limited near-shore distribution continue to be highly relevant.

Nevertheless, the Benin sighting provides continued optimism for locating extant populations of the stout beardfish in other potential range states including Guinea, Liberia, Côte d'Ivoire, Ghana, Togo, Nigeria, Equatorial Guinea and the Democratic Republic of the Congo. As previously highlighted determining the status of this species should be a conservation priority and urgently requires systematic and focused research effort throughout its geographical range (both confirmed and potential range states).

Polymixia nobilis occurs frequently in the Canary Islands (Garcia-Mederos et al. 2010).Experimental fishing surveys carried out on the Sierra Leone Rise by Spanish commercial vessels captured this species in the vicinity of seamounts. Polymixia nobilis, which was captured at depths ranging from 707-1,174 m, was considered a discard species, not of interest to large commercial fleets. It was present in low numbers at all sampled seamounts (Ramos et al. 2001).

Polymixia nobilis is abundant in museum collections (56 lots), and lots typically contain one to two individuals, although several lots contain >4 individuals (Fishnet2 2013).

The species is subject to small-scale exploitation in a context of multi-species fisheries, but there are no other specific threats to *P. nobilis*. In the Canary Islands, catches are relatively important within the local small-scale fisheries. The species is fished year round with line-and-hook (mainly off El Hierro Island) and trammel nets (mainly in the eastern sector of Tenerife Island).

In European waters, *Polymixia nobilis* is taken in a small-scale demersal fishery off the islands of Gran Canaria and El Hierro (Canary Islands) by handline and bottom drop line which primarily target *Beryx splendens*. Separate statistics are not reported, however catches are aggregated with targeted *Beryx spp*. and range from 2.5 tonnes in 1991 to 17.5 tonnes in 1995 (Rico *et al.* 2001, Durr and Gonzalez 2002). This is a relatively important local, small-scale fishery, in the Canaries (Garcia-Mederos *et al.* 2010).

The fish specimen is kept in the laboratory museum in 70 ° alcohol in the bottle. We trained student on the species (Photo 3).

***Photo 3**: Two specimens in alcohol in the museum*

Conclusion

This species is identified once in Benin continental shelf. Since the first record, there was no more observation. Monitoring of marine species continue with fishermen along the beach and onboard the trawler; so we hope that we could find other specimen in the future. The fishermen don't know this species name in vernacular language; thus we can confirm that they never meet the species during their activities. Till to now, we didn't observe another specimen. We follow to now exactly why the species appear in Benin catch.

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MATHEMATICAL SCIENCES

INNOVATIVE APPROXIMATE METHOD FOR SOLVING KRANZZ PROBLEMS WITH INTERVAL COEFFICIENTS

Mamedov K.,
Baku State University
Institute of Control Systems Ministry of Science and Education
Niyazova R.,
Institute of Control Systems Ministry of Science and Education
Huseynov S.
Institute of Control Systems Ministry of Science and Education

ИННОВАТИВНЫЙ ПРИБЛИЖЁННЫЙ МЕТОД РЕШЕНИЕ ЗАДАЧ О РАНЦЕ С ИНТЕРВАЛЬНЫМИ КОЭФФИЦИЕНТАМИ

Мамедов К.Ш.,
Бакинский Государственный Университет
Институт Систем Управления Министерство Науки и Образования
Ниязова Р.Р.,
Институт Систем Управления Министерство Науки и Образования
Гусейнов С.Я.
Институт Систем Управления Министерство Науки и Образования
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Abstract

On the basis of knapsack problems with interval coefficients, optimistic and pessimistic problems are constructed. After that, approximate (suboptimal) solutions to these problems are found. Further, an algorithm is proposed to catch these decisions, which we call innovative. The programs of these algorithms were compiled and comparative computational experiments were carried out.

Аннотациа

В работе на основе задач о ранце с интервальними коэффициентами построены оптимистические и пессимистические задач. После этого, находиться приближённые (субоптимальные) решения этих задач. Далее, предложен алгоритм уличищение этих решений, который называем инновативный. Составлены программы этих алгоритмов и проведены сравнительные вычислительные эксперименты.

Keywords: *interval knapsack problems, optimistic and pessimistic problems, innovative approximate solution, computational experiments.*

Ключевые слова*: интервальные задачи о ранце, оптимистические и пессимистические задачи, инновативные приближённые решение, вычислительные эксперименты.*

1. **Введение**: Рассматривается следующая задача:

$$\sum_{j=1}^{n} c_j x_j \to \max, \qquad (1)$$

$$\sum_{j=1}^{n} a_j x_j \le b, \qquad (2)$$

$$x_j = 0 \vee 1,\ (j=\overline{1,n}). \qquad (3)$$

Здесь $c_j > 0$, $a_j > 0$, $(j=\overline{1,n})$, $b > 0$ заданные целые число. Эта задача известно из литературы и разработаны различные методы построения точного и приближённого решение $[1-5]$и др. Отметим что, это задача входить в класс *NP*- трудный $[15]$. Другими словами, для нахождения оптимального решение этой задачи не существует метод полиномиальной сложности. Поэтому разработаны быстроработающие алгоритмы для построения приближённых (субоптимальных) решений этой задачи $[3-7]$ и др.

В одной экономической интерпретации задачи (1)-(3) коэффициенты c_j $(j=\overline{1,n})$, означают прибыли при использовании *j*-го $(j=\overline{1,n})$ объекта, a_j $(j=\overline{1,n})$ означают расходы для использование *j*- го объекта, а число *b* означает выделенный общий ресурс.

Очевидно что, в условиях современной рыночной экономике расходы a_j $(j=\overline{1,n})$, прибыли c_j $(j=\overline{1,n})$, и выделенный общий ресурс *b* нельзя принимать как заданные фиксированные число, поскольку в этом случае соответствующий модель процесса будет представлен не адекватно. Поэтому, нужно составить модель, который разрешен изменение этих коэффициентов в некоторых интервалах .

Естественно, что составленный такой модель будет описывать рассмотренный процесс более адекватно.

Таким образом, вместе задачи (1)-(3) можно написать более реальной следующий модель:

$$\sum_{j=1}^{n}[\underline{c}_j,\overline{c}_j]x_j \to \max, \qquad (4)$$

$$\sum_{j=1}^{n}[\underline{a}_j,\overline{a}_j]x_j \le [\underline{b},\overline{b}], \qquad (5)$$

$$x_j = 1 \vee 0, (j=\overline{1,n}). \qquad (6)$$

Здесь $0 < \underline{c}_j \le \overline{c}_j, 0 < \underline{a}_j \le \overline{a}_j, (j=\overline{1,n}), 0 < \underline{b} \le \overline{b}$ и целые.

Очевидно что, если в задаче (4)-(6) концы интервалов совпадают, то получается задача (1)-(3).

Таким образом, задача (4)-(6) является обобщением задача (1)-(3). Отметим что, задача (4)-(6) рассмотрены и исследованы различным авторами $[8-13]$ и др.

Во всех этих работах выбираются конкретные число, представляющий каждый интервал и на основе этого строится некоторая задача типа (1)-(3). Решение полученный задачи принимаются как решение задач (4)-(6).

Мы, на основе выше приведенный экономической интерпритации задачи (1)-(3), выбирая оптимистической и пессимистической стратегии построили соответствующий задаче о ранце. Далее, применяя известных методов, построили приближённые решение этих задач, а потом разработали алгоритмы улучшение найденных решений. При разработке этих алгоритмов основной цель заключается в том, что они должны быть новые, легко применяемые для решение практических задач, дает более лучшее решение и был простым с точку зрения программирование. Поэтому такое решение нами названы инновативного приближённого решения [9].

2. Подстановка задачи.

Прежде всего отметим что, для решение задачи (4)-(6) нужно использовать операции над интервалов различной размерности. Поскольку, при этом встречается ситуации, где сумму некоторых различных интервалов должны быть не меньше, чем заданный интервал или сумму соответствующих интервалов должны быть максимально. Однако, такие понятие, вообще говоря в математике отсутсвует. Только в книге [14] рассмотрены некоторые операции относительно интервалов, но применить эти правило для задач оптимизации нельзя. С другой стороны, имеются некоторых подходов [8] для приближённого решения (4)-(6), основанный на некоторых стратегии. Во всех этих подходах выбирается некоторые представители $\tilde{c}_j, \tilde{a}_j$, $(j=\overline{1,n})$ и $\tilde{b}$ для соответствующих заданных интервалов $[\underline{c}_j,\overline{c}_j]$, $[\underline{a}_j,\overline{a}_j]$, $(j=\overline{1,n})$ и $[\underline{b},\overline{b}]$. В результате , решается известная задача о ранце и найденное решение принимается как приближенное решение для задачи (4)-(6).

Отметим, что в работе [9] выбирая оптимистическое и пессимистическое стратегия построен соответствующие задаче о ранце. В этих задачах принимая $\tilde{c}_j=\overline{c}_j$, $\tilde{a}_j=\underline{a}_j$, $(j=\overline{1,n})$ и $\tilde{b}=\overline{b}$ строится оптимистическая задача и выбирая $\tilde{c}_j=\underline{c}_j$, $\tilde{a}_j=\overline{a}_j$ $(j=\overline{1,n})$ и $\tilde{b}=\underline{b}$ строится пессимистическая задача. После этого , полученные приближенные решения этих задач принимается как приближённое решение задача (4)-(6).

Проведенные вычислительные эксперименты показывает что, можно ещё улучшить найденных приближенных решений. Однако, такие алгоритмы должны быть простые, имеющий прикладные значения и качественные, в том числе не представлял трудности с точка зрения программирования. Решения, обладающие таких свойств называем инновативное приближённое решения [9].

Таким образом, мы рассматриваем следующие две задачи, которые называется оптимистическим и пессимистическим соответственно.

$$\sum_{j=1}^{n}\overline{c}_j x_j \to max, \qquad (7)$$

$$\sum_{j=1}^{n}\underline{a}_j x_j \le \overline{b}, \qquad (8)$$

$$x_j = 1 \vee 0, (j=\overline{1,n}), \qquad (9)$$

и

$$\sum_{j=1}^{n}\underline{c}_j x_j \to max, \qquad (10)$$

$$\sum_{j=1}^{n}\overline{a}_j x_j \le \underline{b}, \qquad (11)$$

$$x_j = 1 \vee 0, (j=\overline{1,n}). \qquad (12)$$

Нами разработаны алгоритмы для построения инновативного приближённого решение этих задач.

3. Теоретическая обоснования метода.

В дальнейшем будем называть задачи (7)- (9) оптимистическое, а (10)-(12) пессимистическое.

Поскольку в задаче (7)-(9) обеспечивается максимальность общего дохода за счёт малого расхода, то оно называется оптимистический.

А в задаче (10)-(12) рассматривается выбора таких объектов, который обеспечивает максимальной прибыл за счёт большого расхода с меньшим прибылом . Поэтому эта задача называется пессимистическая.

Мы разработали инновативный приближённый (субоптимальной) алгоритм для решение оптимистической задачи. Отметим, что аналогично можно построит инновативного решение для пессимистической задачи (10)- (12).

Не нарушая общности предположим что, коэффициенты задачи (7)-(9) упорядочены в следующем порядке:

$$\frac{\overline{c}_1}{\underline{a}_1} \ge \frac{\overline{c}_2}{\underline{a}_2} \ge \cdots \ge \frac{\overline{c}_k}{\underline{a}_k} \ge \cdots \ge \frac{\overline{c}_n}{\underline{a}_n} \qquad (13)$$

Здесь отношение $\overline{c}_j/\underline{a}_j$,$(j=\overline{1,n})$ означает прибыл за единичное расход при выборе j-того обьекта.

Отметим что, оптимистическая задача (7)-(9) является известная задача о ранце и для нахождения оптимальное решения $X^*=(x_1^*,x_2^*,\dots,x_n^*)$ этой задачи не существует методы полиномиальной сложности. [15]. Другими словами, все известные методы нахождения оптимального решения требует операции в порядке 2^n. Очевидно что, для больших значений n, это задача не решается за реальное время. Поэтому она называется NP –полный или NP- трудный.

Однако, для нахождения приближённого (суб-оптимального) решения $\underline{X}^o=(\underline{x}_1^o,\underline{x}_2^o,\dots,\underline{x}_n^o)$ можно использовать следующие правила.

Для каждого j, (j=1,2,...,n)

$$\underline{x}_j^o=\begin{cases}1,\text{если } \sum_{i=1}^{j-1}\underline{a}_i\underline{x}_i^o+\underline{a}_j\le\overline{b}\,,\\ 0,\text{если } \sum_{i=1}^{j-1}\underline{a}_i\underline{x}_i^o+\underline{a}_j>\overline{b}\,.\end{cases} \qquad (14)$$

Отметим что, найденные решение $\underline{X}^o=(\underline{x}_1^o,\underline{x}_2^o,\dots,\underline{x}_n^o)$ по формуле (14) в работе [8] названо субоптимистическое решения для интервальные задаче (4)-(6). Кроме того , значения $\underline{f}^o$ функции (7) для субоптимистического решения определяется следующим образов.

$$\underline{f}^o=\sum_{j=1}^{n}\overline{c}_j\underline{x}_j^o$$

Естественно что, найденное субоптимистического решение $\underline{X}^o=(\underline{x}_1^o,\underline{x}_2^o,\dots,\underline{x}_n^o)$ может не совпадать оптимистическим или может строго отличается от оптимистического решения. Поэтому, появляется необходимость возможного улучшения найденной субоптимистической решений.

С другой стороны, необходимо оценить погрешности найденных субоптимистических решений $\underline{X}^o=(\underline{x}_1^o,\underline{x}_2^o,\dots,\underline{x}_n^o)$ или инновационных приближённых решений $\underline{X}^{iy}=(\underline{x}_1^{iy},\underline{x}_2^{iy},\dots,\underline{x}_n^{iy})$ от оптимистического решения. С этой целью обычно условия (9) заменяют на $0\le x_j\le 1,(j=\overline{1,n})$. Тогда область допустимых решений расширяется и максимальное значение функции (7) увеличивается. Поэтому можно принимать это значения как верхняя граница для оптимистических или субоптимистических значений. В результате можем оценить погрешности инновационных субоптимистических решений от оптимистического. Отметим что, после замены условия (9) на $0\le x_j\le 1,(j=\overline{1,n})$, оптимальное решения полученный задача определяется аналитическое следующие известной формулой.

Для каждого номера j , (j=1,2,..,n)

$$\bar{x}_j=\begin{cases}1,\text{если } \sum_{i=1}^{j-1}\underline{a}_i\bar{x}_i+\underline{a}_j\le\overline{b}\,,\\ \left(\overline{b}-\sum_{i=1}^{j-1}\underline{a}_i\bar{x}_i\right)\Big/\underline{a}_j\,,\text{если } \sum_{i=1}^{j-1}\underline{a}_i\bar{x}_i+\underline{a}_j>\overline{b}\,,(k\coloneqq j),\\ 0,\text{для } j=k+1,k+2,\dots,n\,.\end{cases} \qquad (15)$$

Тогда значение функции (7), соответствующий этому решении составляет.

$$\bar{f}=\sum_{j=1}^{n}\overline{c}_j\bar{x}_j$$

Очевидно что,

$$\underline{f}^o\le\underline{f}^{iy}\le f_*^o\le\bar{f} \qquad (16)$$

Здесь $\underline{f}^{iy}=\sum_{j=1}^{n}\overline{c}_j\underline{x}_j^{iy}$,$f_*^o=\sum_{j=1}^{n}\overline{c}_j\,x_j^*$,

и $X^*=(x_1^*,x_2^*,\dots,x_n^*)$ является оптимальное решения оптимистической задачи (7)-(9).

Используя соотношения (16) можно найти абсолютные и относительные погрешности следующием образом

$$\Delta^o\le\bar{f}-\underline{f}^o,\delta^o\le\frac{\bar{f}-\underline{f}^o}{\bar{f}}.$$

Отметим что, решение $\overline{X}^o=(\overline{x}_1^o,\overline{x}_2^o,\dots,\overline{x}_n^o)$ найденные формулой (15) имеет следуюший структуры.

$$\overline{X}^o=\Big(\underbrace{1,1,\dots,1}_{k-1},\alpha_k/\beta_k\,,\underbrace{0,0,\dots,0}_{n-k}\Big) \qquad (17)$$

Отсуда видно что, в этом решение только один κ-ый координат $\overline{x}_k^0$ может принимать дробное значение $\overline{x}_k^0=\alpha_k/\beta_k$.

Здесь же запомним, что если значение $\overline{x}_k^0$ будет 0 или 1, то это решение является оптимальным решение задача (7)-(9) и будет оптимистическом решением для задаче (4)-(6). На этом процесс решения заканчивается.

Необходимо отдельно отметит следующие обстаятелство: многочисленное вычислительное эксперименти показывают, что при построении приближённого решение $\underline{X}^o=(\underline{x}_1^o,\underline{x}_2^o,\dots,\underline{x}_n^0)$ по формуле (14) координаты отличающихся от оптимального решение находится в некоторой окрестности κ-го координата в (17). Другими словами, для построение более лучшего приближенного решения, в некоторой близкий окрестности $\overline{x}_k^0$ можно заменить по очередно координать получивших “1” на “0” или “0” на “1”.

Отметим, что для выбора близкий окрестности $[k-p,k+p]$ число p в работе [5] определено из следуюшего соотношение

$$p=arg\left\{\max_i\left(\frac{\overline{c}_{k-i}}{\underline{a}_{k-i}}-\frac{\overline{c}_{k+i}}{\underline{a}_{k+i}}\right)\le\delta\right\}$$

Здесь $\delta>0$ фиксиривинное постаянное число. Отметим что, если номер переменной κ , найденное по формуле (15) будет близко к число переменных

n то, отрезок $[k-p, k+p]$ теряет своей симметричности и в результате можем встречается некоторой неопределенности. Поэтому в качестве окрестности κ-го координата принимаем $[\delta_k^1, \delta_k^0]$.

Здесь

$$\delta_k^1 = \left[k \cdot \frac{q}{100}\right], \delta_k^0 = \left[(n-k) \cdot \frac{q}{100}\right],$$

число q означает процент изменение , а $[z]$ – означает целый часть число z. Тогда можно построит новые решения, измененяя каждый координаты $\overline{x}_k$ в окрестности $[k-\delta_k^1, k)$ и $[k, k+\delta_k^0]$ следуюшем образом:

Заменяя каждый $\overline{x}_{j_*}^o = 1$, $\left(j_* = \overline{k-\delta_k^1, k-1}\right)$ на $\underline{x}_{j_*} = 0$ и каждый $\overline{x}_{j_*} = 0$, $\left(j_* = \overline{k, k+\delta_k^0}\right)$ на $\underline{x}_{j_*} = 1$ построим новые решения по формуле (14). Тогда начальное решение $\underline{X}^o = \left(\underline{x}_1^o, \underline{x}_2^o, \dots, \underline{x}_n^0\right)$ превращается на новую решение $\underline{X}^1 = \left(\underline{x}_1^1, \underline{x}_2^1, \dots, \underline{x}_n^1\right)$.

Здесь $\underline{x}_j^1 = \underline{x}_j^0, (j = \overline{1, j_* - 1}), x_{j_*}^1 := 0$ фиксируются и остальные координаты $\underline{x}_j^1, (j = \overline{j_* + 1, n})$ определяется по формулой (14). После этого вычисляется значений $\underline{f}^1$ функций (7):

$$\underline{f}^1 = \sum_{j=1}^{n} \overline{c}_j \underline{x}_j^1$$

При этом если $\underline{f}^1 > \underline{f}^0$, то решений $\underline{X}^1 = \left(\underline{x}_1^1, \underline{x}_2^1, \dots, \underline{x}_n^1\right)$ и значение $\underline{f}^1$ запоминается.

Допустим что, проведены t-число процесс построение решений и для каждый построенной новый решении $\underline{X}^t = \left(\underline{x}_1^t, \underline{x}_2^t, \dots, \underline{x}_n^t\right)$ вычислены значения

$$\underline{f}^t = \sum_{j=1}^{n} \overline{c}_j \underline{x}_j^t$$

Определение. Если в некоторой шаге t, $(t = 1,2,\dots)$ удовлетворяется условия $\underline{f}^t > \underline{f}^{t-1}$, то решение $\underline{X}^t = \left(\underline{x}_1^t, \underline{x}_2^t, \dots, \underline{x}_n^t\right)$ называем инновативное субоптимистическое решение.

Здесь

$$\underline{f}^{t-1} = \sum_{j=1}^{n} \overline{c}_j \underline{x}_j^{t-1}$$

Замечание. Очевидно что, выше указанным методом можно построит максимум $\delta_k^0 - \delta_k^1$ число решений. Здесь число $\delta_k^0 - \delta_k^1$ показывет длины интервал $[\delta_k^1, \delta_k^0]$. Поскольку это число невелик по сравнений число неизвестных n, то выше указанный процесс построения инновативного субоптимистического решение завершается после конечного число шагов. Отметим что, последное среди запомненных решений принимается как окончательное инновативное субоптимистическое решение.

Необходимо отметим еще одного обстоятельство. Дело в том что, решение найденное методом настоящий работы либо совпадает решением полученный методом работы [8] , либо будет более лучший. Ибо, в качестве начального решения принимаются решения, полученный применением метода работа [8]. Очевидно что, если субоптимальное решение, найденных методом работы [8] совпадает с оптимальным решением, то оно не может быть улучшено. Иначе, можно найти более лучшего решения. Резултаты экспериментов, представленных в пункте 4 еще раз показал что, разработанный в данный работе метод в большинство случае дает лучщее решение.

Отметим что, процесс построение инновативного субоптимистическо решение для пессимистической задачи (10)-(12) является аналогично выше указанный.

4. Результаты вычислительных экспериментов.

Для выявления качество выше указанных методов проведены ряд вычислительных экспериментов над задач различной размерности со случайными коэффициентами. С этой целью составлены программы этого метода.

Коэффициенты решенных задач являются целые число, удовлетворяющим следующим условиям

$$0 < \underline{c}_j \le \overline{c}_j \le 999, 0 \le \underline{a}_j \le \overline{a}_j \le 99, (j = \overline{1, n}),$$

$$\underline{b} = \left[\frac{1}{3}\sum_{j=1}^{n} \underline{a}_j\right], \overline{b} = \left[\frac{1}{3}\sum_{j=1}^{n} \overline{a}_j\right].$$

Здесь [z] показывает целый часть число z.

Результаты проведенных экспериментов представлены в следующей таблице.

Таблица.

Субоптимистическое и субпессимистическое значения и погрешности.

n	100	200	500	1000
$\underline{f}^o$	25783	46596	87443	324546
$\underline{f}^{yo}$	25934	46596	88304	327124
$\overline{f}^o$	26214	46724	88425	327236
δ^{yo}	0,0106	0,0027	0,0013	0,0003
δ^o	0,0164	0,0027	0,0111	0,0082
$\underline{f}^p$	16739	23736	42636	125435
$\underline{f}^{yp}$	16840	23904	42740	125942
$\overline{f}^p$	16961	24010	42855	126104
δ^{yp}	0,0071	0,0044	0,027	0,0013
δ^p	0,0131	0,0114	0,0051	0,0053

В таблице приняты следующе обазначения:

n- число неизвестных.

$\underline{f}^{o}$ – начальное субоптимистическое значения функции (7)

$\underline{f}^{yo}$ – улучшенное субоптимистическое значения функции (7)

$\overline{f}^{o}$ – верхняя граница оптимистическое значения.

δ^{yo}- относительное погрешность инновативного субоптимистического значения $\underline{f}^{yo}$ от верхней границы $\overline{f}^{o}$, т.е. $\delta^{yo} = \frac{\bar{f}^{0} - \underline{f}^{yo}}{\bar{f}^{0}}$.

δ^{o}- относительное погрешность начального субоптимистического значения $\underline{f}^{o}$, от верхней границы $\overline{f}^{o}$, т.е. $\delta^{0} = \frac{\bar{f}^{o} - \underline{f}^{o}}{\bar{f}^{0}}$.

$\underline{f}^{p}$- начальное субпессимистическое значения функции (10)

$\underline{f}^{yp}$- улучшенное субпессимистическое значения функции (10).

$\overline{f}^{p}$- верхняя граница пессимистическое значение.

δ^{yp} – относительное погрешности инновативного субпессимистического значения $\overline{f}^{yp}$ от верхней границы $\overline{f}^{p}$, т.е. $\delta^{yp} = \frac{\bar{f}^{p} - \underline{f}^{yp}}{\bar{f}^{p}}$.

δ^{p} - относительное погрешности начального субпессимистического значение $\underline{f}^{p}$, от верхней границы $\overline{f}^{p}$, т.е. $\delta^{p} = \frac{\bar{f}^{p} - \underline{f}^{yp}}{\bar{f}^{p}}$.

На основе этой таблицы можно сделать следующие выводы.

- Почти во всех решенных задачах встречался улучшение начального решение. Только в одной задаче при $n = 200$ начальное субоптимистическое решение не улучшено. Может быть в этой задаче начальное субоптимистическое значение $\underline{f}^{o} = 46596$ было оптимально. Поэтому ее улучшить не возможно.
- Во всех решенных задачах субоптимистическое и субпессимистическое значение целовой функции не строго отличается от соответствующий вверхней границы. Другими словами инновативного субоптимистического и субпессимистического значения было близко к соответствующих оптимистических и пессимистических значений. А это очень важно при решение реальных практических задач.
- Относительные погрешности для оптимистических и пессимистических значений были достаточно меньше. Только в одной задаче , при $n = 100$ относительное погрешности составил 0,0106, т.е. 1%. Для остальных задач относительное погрешности субоптимистических и субпессимистических значений от соответствующий оптимистических и пессимистических значений было меньше, чем 1 %. Поскольку, относительные погрешности были достаточно меньше , то это обстоятельство ещё раз подтверждает высокие качество разработанного метода. А это показывает, что этим методом можно использовать качественно при решении реальных практических задач.

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PEDAGOGICAL SCIENCES

AN EFFECTIVE WAY TO INCREASE THE QUALITY OF EDUCATION

Yeleusinov B.,
candidate of physical science, professor,
head of Branch JBC «National Training Center «Orleu», Department of scientific and natural discipline, Kyzylorda city, Respublica of GazaGstan;
Marsali R.,
master of historyBranch JBC «National Training Center «Orleu» Department of scientific and natural discipline, Kyzylorda city, Respublica of GazaGstan;
Kuseinov S.,
master of pedagogy Branch JBC «National Training Center «Orleu» Department of scientific and natural discipline, Kyzylorda city, Respublica of GazaGstan;
Ormanov U.
magistr of physics Branch JBC «National Training Center «Orleu» Department of scientific and natural discipline, Kyzylorda city, Respublica of GazaGstan
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Abstract

The article provides in detail that the indicator of the quality of Education directly depends on the quality of teachers ' activities. What should be taught to students is established by state standards, programs. Well, "how to teach?"the answer to the question "" should be sought only in the professional training of the teacher, in the ability to plan his own business, in the ability to predict and see his real goals and organize the child's actions."

Keywords: *education, quality, teachers, school, theoretical and practical experience. professional qualifications, pedagogical, pedagogic science, competence, English language, educational-methodological complex.*

The indicator of the quality of education is directly related to the quality of teachers' work. What should be taught to students is determined by state standards and programs. And, "how to teach?" the answer to the question should be sought only from the professional training of the teacher, the ability to plan his work, the skill of predicting and seeing his specific goals and organizing the child's actions.

The main person in the development of school work and student achievements is the teacher. Requirements for the teacher's professional level (professional knowledge, skills and abilities) are provided in the description of professional qualifications.

Professional qualifications are the stages of professional training of an employee, allowing them to perform a certain level of work duties in a particular type of activity. That is, qualification is a set of requirements for the level of theoretical and practical experience.

Professional development is a teacher's participation in professional development activities and education through special educational programs in order to effectively perform his/her duties and to raise his/her professional level.

The Institute carries out professional development activities in two directions: in courses and inter-course events. These works are reflected in theoretical lectures, interactive seminars and practical classes.

Pedagogical activities and situations are created in the system of professional development of the teacher for self-determination, strengthening of competition, formation of competence. It is aimed to form the subject-theoretical, methodological, methodological preparation and research culture and professional competence of each student through practical trainings and seminars.

One of the main concepts in modern pedagogic science is the concept of "competence". American scientist N. Chomsky, who first defined the term "competence" and introduced it into science. "Competence" (Latin word) competence means capable, concerned. Competence is the presence of knowledge, skills, business, willpower in a person, student and includes such concepts as "knowledge", "ability" and "skill". That is, competence is the ability to use acquired knowledge and skills in practice, in everyday life to solve some practical and theoretical problems, the result of education reflected in the quality of the student's actions. Subject competence is a qualitative set of knowledge, skills, abilities and actions related to certain subjects in educational activities, the ability to use the foundations of pedagogical and social psychology.

In the theoretical lectures, the listeners get acquainted with the conditions for a new evaluation of the educational achievements of students, and they share their ideas about the criteria for the new evaluation of the educational achievements of the students and share their experiences. This increases the effectiveness of the courses. And in the practical lessons they learn to plan lessons, to differentiate tasks, to work with extended, competence tasks. At the end of the course, listeners will defend their projects and others will evaluate them. It contributes to the productivity and effectiveness of the courses.

Tasks of competence type are composed as follows: stimulus-situation; formulated task; source of information; filling sheet (answer sheet); inspection tool; response sample. The stimulus situation motivates the student to complete the task. The conditions of the problem, which are the basis for describing the situation or sources of information, are considered. The source of information should be relevant, interesting and appropriate for the learning age. Checking how well the tester performed the assigned tasks in which areas. Sample answer - correct and possible answers, key - samples of student answers, answer form - the process of the student's activity to complete the task.

On the basis of this information, the trainees will compile competence tasks through group work and work on small projects. The group of experts and other groups will evaluate the created competence tasks.

The use of competence tasks in the classroom helps the teacher to solve several tasks at the same time during the lesson: to determine the level of development of key competences of students; determining the level of development of subject knowledge and skills; assessment of the child's ability to independently acquire knowledge and choose methods of action in order to achieve the goal set in the task; formation of interest in the subject through the development of research.

Pupils learn how to read, and as a result, they become free, able to convincingly present their own arguments, motivated, reliable, have systematically developed critical views, and are formed as individuals who are proficient in digital technologies.

In the Republic of Kazakhstan, from 2012 to 2016, level courses were conducted in the direction of improving the qualifications of teaching staff, and from 2016 to 2021, courses were conducted on the programs of updating the content of secondary education. That is, in the period from 2012 to 2021, courses on improving the subject competence of teachers were not held in the country. In order to improve the quality of education and fill this gap, the “Orleu” National Center for Pedagogical Development” has recently been developing training programs in a new format within the scope of subject competencies and focusing on conducting advanced training courses. In addition, large-scale work is being carried out in the direction of increasing the quantitative competence of teaching staff.

In August-October 2021, all teachers of the country passed distance learning courses on the topic "Development of Digital Competence of Teachers" prepared by “Orleu” National Center for Pedagogical Development”. Teachers of Kyzylorda region participated in this course and were certified.

Between March 2021 and March 2022, a distance learning course was organized for English language teachers under the Future English Online Teacher Community Program within the framework of cooperation between the JSC “Orleu” NCPD” and the British Council International Organization in order to improve the subject competence of teachers. Within the framework of the project, 2,000 English language teachers of general education schools in the country passed the course. The training was free of charge and English language teachers were required to have at least B1 level of English to participate in the training. 125 English language teachers participated in Kyzylorda region, and according to the test results, 26 of them successfully completed the course and received international certificates.

Between May 3 and June 15, 2022, the best trainers of Orleu, together with the EdCrunchAcademy company, studied the principles of creating programs and educational-methodological complex for the development of educational programs within the framework of subject competencies, and created their own author's programs.

The authors of the program mastered the methodology of developing educational programs and the basics of testology using the principle of reverse design, and formulated the goals, objectives and expected results during the development of educational programs. Based on the learning results, the design work of practical and assessment tasks.

44 educational programs were developed in 12 subjects such as mathematics, computer science, physics, chemistry, biology, geography, natural science, Kazakh, Russian and English languages, history and primary classes.

From August 1, training courses for subject teachers began in “Orleu” branches in all regions of the country. 46,340 teachers are scheduled to undergo courses to increase their subject competence by November 18 under 44 programs developed in accordance with modern requirements for all classes. Among them, 2925 trainees in Kyzylorda region will improve their qualifications.

Before starting the courses, the teachers undergo a diagnostic test on the digital platform. Diagnostic testing helps to determine the level of subject knowledge of teachers before the start of courses and to evaluate the effectiveness of educational programs. Based on the results of training in the courses, the analysis of the effectiveness of teaching and the final assessment of their acquired knowledge are carried out in order to improve the qualifications of teachers. International experience shows that educational programs aimed at increasing subject competences have a positive effect on the professional development of teachers and the increase in the quality of their work. It also contributes to the increase of the general quality of education, including the student's educational index.

In the courses, it is aimed to form the subject-theoretical, methodological, methodical preparation and research culture and professional competence of each student through practical trainings and seminars. In the theoretical lectures, the listeners get acquainted with the conditions for a new evaluation of the educational achievements of students, and in the seminars, they share their ideas about the criteria for the new evaluation of the educational achievements of the students and share their experiences. This increases the effectiveness of the courses. And in the practical lessons organized by the methods and forms of active learning, they learn to plan competence lessons, to differentiate in the lesson, to work with extended, competence tasks. At the end of the course, students will defend their projects in these areas, and others will evaluate them. That is, the effectiveness and efficiency of the courses increases, subject teachers receive professional education and improve their professional qualifications. This is an effective way to improve quality.

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APPLICATION OF REVERSE EMULSIONS FOR SILENCING AND STIMULATION OF OIL WELLS AT THE UZEN FIELD

Kadyr A.
Master's degree "6M07202-Oil and Gas Engineering"
Oil and Gas Faculty
Atyrau University of Oil and Gas named after Safi Utebayev
https://doi.org/10.5281/zenodo.7311408

Abstract

Over the past decades, the strategic direction in solving these problems has been the development of methods for influencing the formation as a whole, which are currently quite well developed and widely used in the fields. After major or current repairs, there is a decrease in productivity in all wells as a result of the contamination of the productive reservoir during jamming and actual repair. One of the main reasons for the decrease in the productivity of wells after repair is the inconsistency of the applied jamming fluids (JF) with geological and technical conditions.

The task of the well jamming operation is to ensure safe working conditions for drilling and repair crews in the wellbore by preventing the release of oil or gas from the reservoir. The use of reverse emulsions for silencing and stimulation of oil wells stimulates. The goal is to improve the composition of reverse emulsions for silencing and stimulation of oil wells.

The solution of this problem is possible with the help of various compositions of silencing formations that create pressure at the bottom of wells above the reservoir. By changing the composition of the jamming fluid, it is possible to obtain a reverse emulsion designed for jamming wells and simultaneous processing of the bottom-hole zone of the productive formation.

Keywords: *deposit, silencing, emulsion, bottom-hole zone of a productive formation.*

The Uzen field is an oil and gas field in the Mangystau region of Kazakhstan, on the Mangyshlak peninsula. It belongs to the South Mangystau oil and gas region.

It was discovered in 1961 by driller Gaziz Abdrazakov. Deposits at a depth of 0.9-2.4 km. The oil flow rate is 10-81 t/day. Gas flow rate from 8,0 to 230 thousand m3/day. Oil density is 844-874 kg/m3, sulfur content is 0.16-2%, paraffins are 16-22%, resins are 8-20%.

Oil reserves are 1.1 billion tons. The mining center is the city of Zhanaozen.

The operator of the field is the Kazakh oil company KazMunayGas Exploration Production. Oil production in 2008 amounted to 7 million tons. The record level of oil production — 16.3 million tons — was recorded in 1975, the minimum — 2.7 million tons — in 1994.

The reverse emulsions applied at the field during well silencing and simultaneous processing of the bottom-hole zone of the productive formation, consists of an external [1-6] (dispersion) medium, an internal (dispersed) phase and an emulsifier-stabilizer. A distinctive feature of this emulsion is that the composition of the dispersion medium contains a hydrocarbon solvent.

The components of the reverse emulsion are taken in the following ratio. volume %: oil (commercial) - 30-10; hydrocarbon solvent - 29.0-27.5; emulsifier - 1.0-2.5; aqueous phase-40-60

If necessary, a solid weighting agent (barite, siderite, hematite) up to 25% by volume can be introduced into the composition of the finished emulsion.

Oil should be anhydrous and preferably low-viscosity.

As a hydrocarbon solvent, a wide fraction of light hydrocarbons is used, which is obtained during the preparation of oil at the COTS (complex oil treatment site) and is called "Distillate" in field practice. Before entering into the emulsion, the distillate must be degassed.

ES-2, a reagent used to stabilize hydrophobic emulsion solutions, is used as an emulsifier.

Reservoir water containing calcium ions, aqueous solutions of CaCl2, NaCl, MgCl2 salts of any concentration, as well as their mixtures can be used as an aqueous phase.

A solid weighting agent (barite, siderite, hematite, etc.) is introduced when high values of the density of the reverse emulsion are required. The weighting agent is used only conditioned, i.e. dry and loose.

The reverse emulsion has the best technological parameters with an aqueous phase content of 40-50% and a hydrocarbon solvent content in the external environment of at least 50%. These parameters can be within the following limits: density, kg/ m^3 - 900-1400; conditional viscosity, c - 50-200; static shear stress, mgs / cm2 after 1 min and 10 min - 6-15 and 8-25; filtration index, cm^3 / 30 min - at least 3, including for hydrocarbon medium, % - not less than 80; electrical stability, (volts) B - 80-200; solvent capacity - at the level of pure distillate.

Reverse emulsions of the above composition, which have a solvent ability to paraffin and asphalt-resinous deposits, can be used in wells with bottom-hole temperatures up to 80 ° C, and weighted with a solid weighting agent - in wells with bottom-hole temperatures up to 50 ° C (Figure 1).

The solidification temperature of reverse emulsions is determined by the solidification temperature of the hydrocarbon medium.

Figure 1. Reverse emulsion of the ES-2 brand

Usually, aqueous formulations with additives of thickeners or mineral salts are used for these purposes. It is also possible to use special mechanical reservoir cut-offs or anti-blowout equipment.

When preparing a well for a secondary opening, processing of the bottomhole zone or repair work, the entire trunk is filled with jamming fluid.

The technology of fluid replacement in the borehole consists in carrying out the operation of flushing the borehole with the admission of tubing to the bottom or sequentially replacing the borehole fluid in the wellhead-pump section with a silencing fluid to ensure filling of the entire borehole [6-8]. One of the main parameters of the jamming fluid is its density.

The density of the silencing fluid determines the amount of pressure at the bottom of the wells. The main goals and objectives of silencing operations of productive formations:

• The silencing fluid must ensure that the pressure at the bottom exceeds the reservoir pressure.

• The silencing fluid must be chemically inert to the rocks composing the reservoir, compatible with reservoir fluids and must exclude irreversible colmation of the pores of the formation by solid particles. The content of suspended particles should not exceed 30 mg/l.

• The silencing liquid filtrate should have an inhibitory effect on clay particles, preventing their swelling at any pH value of reservoir water.

• The silencing fluid should not form water barriers and should contribute to the hydrophobization of the collector surface and the reduction of capillary pressures in the formation pores by reducing the interfacial tension at the interface of the phases "silencing fluid - reservoir fluid" [7-10].

• The silencing liquid should not form persistent oil-water emulsions of the 1st and 2nd kind.

• The rheological properties of the silencing fluid should be regulated in order to prevent its absorption by the productive reservoir.

• The silencing fluid must have a low corrosive effect on Downhole equipment. The corrosion rate of steel should not exceed 0.12 mm/year

• The silencing fluid must be thermostable at high temperatures and be frost-resistant in winter conditions.

• The silencing fluid must be non-flammable, explosion-proof, non-toxic.

At the same time, technologies for the preparation of jamming fluid and their application in wells should ensure ease of preparation and regulation of the properties of the jamming fluid without creating emergency situations and complications in wells.

Well jamming technologies should not hinder the subsequent development and output of wells to the planned operating mode. Factors that worsen the properties of the CCD when jamming fluids penetrate into it:

• swelling of clay minerals contained in reservoir rock;

• blocking effect of water caused by capillary and surface phenomena occurring in the pore space as a result of mutual displacement of immiscible liquids;

• formation of resistant oil-water emulsions in the formation;

• formation of insoluble sediments in the pore space as a result of the interaction of the silencing fluid and reservoir fluids;

• clogging of pores with solid particles penetrating into the formation together with the filtrate (liquid phase).

All silencing fluids are conditionally divided into 2 groups:

• - water-based, in pm foams, fresh and reservoir waters; solutions of mineral salts; clay solutions; hydrogels; direct emulsions.

• - hydrocarbon-based, in pm commercial or thickened oil; reverse emulsions with an aqueous phase content of up to 70%.

In the group of water-based silencing fluids, the leading role belongs to aqueous solutions of mineral salts or pure brines that do not contain a solid phase.

Complicating factors in silencing wells with mineral salts:

• Interaction of water and salt solutions with clay minerals

• Formation of poorly soluble salts

• Formation of emulsions

• Formation of a water blockade

Additives to aqueous silencing solutions that reduce the negative impact of aqueous solutions of silencing fluids on the formation filtration and capacitance properties (FCP):

Salt deposition inhibitors;

Corrosion inhibitors;

Hydrophobizers and inhibitors of clay swelling;

Demulsifiers.

Salt deposition inhibitors

To prevent the penetration of salt-based silencing fluids into the formation, various thickened silencing fluids are used, which have increased viscosity and have a low filtration coefficient into the formation. The use of thickened silencing fluids is associated with reduced reservoir pressure when the reservoir pressure is lower than hydrostatic.

Thickened silencing fluids on a hydrocarbon basis. For maximum preservation of reservoir properties of productive formations during the repair work in wells, hydrocarbon-based solutions are recommended as a silencing fluid. The use of such systems preserves the natural water saturation of the pores.

The swelling of clay minerals of the formation is excluded; the blocking effect of water caused by capillary phenomena; the formation of insoluble sediments in contact with mineralized waters; corrosion of equipment, hydrogen sulfide manifestations at the wellhead. The disadvantage of hydrocarbon-based silencing fluids is their fire safety.

Thickened hydrocarbon-based liquids can be divided into reverse emulsions and thickened oil.

Due to the breadth of the range of regulated properties and the relatively low cost, reverse emulsions have found the most widespread.

Reverse emulsions for silencing wells. Currently, emulsion compositions are widely used in various oil production processes: in the processes of primary and secondary opening of productive formations, during well silencing, during treatment of the bottom-hole zone of the formation and in the processes of enhanced oil recovery. At the same time, in each specific case, certain types of emulsions and emulsion compositions specially selected taking into account the necessary physical and chemical properties are used.

Thickened oil. The use of thickened oil makes it possible to reduce the negative effect of the jamming fluid on the PZP and obtain a jamming fluid density of less than 1 g / cm^3. However, with these advantages, thickened oil has a number of significant disadvantages, in pm, the high cost of the extinguishing fluid; high fire safety; complex regulation of rheological properties.

Well jamming technology. To determine the jamming technology, it is necessary to make a number of decisions:

• composition of the main silencing fluid and additives;

• the need to use a blocking fluid.

• The number of jamming cycles is determined by the depth of the downhole equipment.

By default, the process of pumping the jamming fluid should be carried out into the pipe space of the well (direct method). When it is not possible to knock down the pump valve, jamming is performed through the annulus (reverse method).

In the case of high reservoir pressure, when the pressure significantly exceeds the hydrostatic, the injection rate should be maximum, exceeding the productivity of the well, provided that the pressure does not exceed the maximum permissible (according to the pressure conditions of the crimping column or cable entry).

In the case of normal and low reservoir pressure, the pressure is approximately equal to or lower than the hydrostatic pressure in order to minimize downhole pressure, reduce the volume of absorption of borehole fluid by the reservoir, the injection rate of the silencing fluid should not exceed 10 m^3 /hour.

Conclusions. Before drawing up a work plan, it is necessary to determine how the first batch of jamming fluid will arrive at the bottom of the wells. The first pack usually includes a blocking compound.

For Uzen deposits with low permeability of the productive layer or high clay content of the rock, a deposition method is recommended. To determine the required volume of the silencing fluid, it is necessary to calculate the internal volume of the well, taking into account the wall thickness of the pipes, the volume of the lowered tubing, and the depth of the descent of the GNO.

The volume of the first jamming cycle is calculated from the condition that it must be at least the internal volume of the production column in the interval from the depth of the descent of the GNP (tubing shoe) before artificial slaughter.

The volume of the second cycle is calculated from the condition that it must be at least the internal volume of the production column minus the volume of tubing in the interval from the mouth to the depth of the descent of the GNO (tubing shoe). I.e., it must provide a complete change of fluid during flushing in the specified volume.

Possible complications in silencing wells:

• Initially incorrect choice of silencing fluid density

• Overflow of the well as a result of an increase in downhole pressure

• In wells with low-permeability reservoirs, it was found that the recovery period of reservoir pressure lasts from 15 to 20 days, and for a number of wells this period reaches 30 days.

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