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# Nutrition content detection in sea food

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**Abstract**
Fish is an essential living organism on earth. It is highly nutritious than any other consumable species. It is of high protein enriched food. Fish also serve as a vital thing for maintaining the food chain. Nowadays, overfishing has developed as a trend. It is due to the unknown and inadequate knowledge of the people who fish. Fish store a large number of ecosystem nutrients more than other aquatic animals and excrete nutrients in dissolved forms that are used by primary producers. Fish provides protein to more than one billion poor people daily. It provides nutrients and micronutrients that are essential to cognitive and physical development, especially in children, and are an integral part of a healthy diet. But it is suspected that fish might get depleted entirely by the year 2050.
From the study, we obtained the following formula:
Carbohydrate is calculated by using the formula Amount of carbohydrate present in 100mg of sample = (100mg of glucose / test sample volume) x 100
Protein can be estimated by using the formula Amount of protein present in 100mg of sample = %protein = (mg protein) (100) / (mg solid / ml reagent)
Fat calculations are made by using the formula Amount of fat present in 100mg of sample = (100mg of lipid /volume of the test sample) x 100

**Keywords:** nutrition content, fish, seafood, chemical processes, comparison

## 1. Introduction
Seafood mainly provides essential nutrients to our body. They are vitamins A, B, and D, as well as omega-3 fatty acids. Fish has large amount of calcium and phosphorus and a source of minerals, such as iron, zinc, iodine, magnesium, and potassium. Vitamin A helps us to protect vision and boost our immune systems.

## 2. The Anthrone Method for the Determination of Carbohydrates
The Anthrone test is one of the best tests for all carbohydrates. In this test, carb gets dehydrated when react with concentrated Sulphuric acid to form furfural. This furfural reacts with anthrone to give a bluish-green complex. Carbohydrates are the most vital component of Storage and structural materials in the plants. The carbs are generally stored as free sugars and polysaccharides. The basic unit of carbohydrates is Monosaccharides.
When hydrolyzing the carbohydrates, it gives monosaccharides. The estimation of the resultant monosaccharides provides the hydrolyzed product of Polysaccharide.
In this test, Carbohydrates are generally dehydrated with concentrated H2SO4 to form "Furfural," which condenses quickly with anthrone to create a green color complex that can be measured by using calorimetrically at 620nm by using a red filter. Anthrone reacts with dextrin's, monosaccharides, disaccharides, polysaccharides, starch, gums, and glycosides. But they may yield of color to form carbohydrates to carbohydride.

### 2.1 Procedure
0.2 to 1ml of a standard solution should be taken in five different test tubes and add some water to bring the volume to 1ml in each test tube, and then 4ml of anthrone reagent should be added. Mix the contents thoroughly and cover the test tube with a bath for about 10 minutes. Then cool the test tube to room temperature and measure the optical density in a photoelectric colorimeter at 620nm by using a red filter. Simultaneously a new Solution with 1ml of distilled water and 4ml of anthrone reagent should be prepared. A calibration curve is constructed on graph paper, by plotting glucose concentration (10 to 100mg) on the x- axis and absorbance at 620nm on the y-axis. The level of sugar in the sample is computed from the calibration curve. While calculating the sugar concentration in the unknown sample, the dilution factor is taken into account.

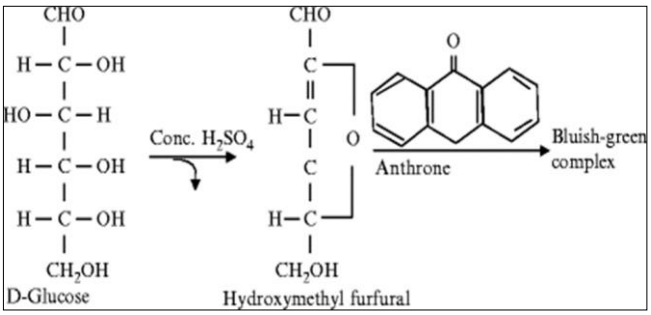


**Fig 1:** Complex formation

## 3. Lowry method for the determination of protein
Protein is found throughout the body in muscle, bone, skin, hair, and other body part or tissue. It is to make up the enzymes that power many chemical reactions and the hemoglobin which carries oxygen in our blood. The blue color formed by the reduction reaction of the phosphor

molybdic- phosphor tungstic components in Folin-Ciocalteau reagent by amino acids tyrosine and tryptophan present in the protein and the color developed by the biuret reaction of the protein with the alkaline cupric tartrate are also measured in the Lowry's method.
Alkaline CuSo4 catalyzes the oxidation of aromatic amino acids with subsequent reduction of sodium- potassium moly date tungstate of Florin's reagent, giving a purple color complex the intensity of the color is directly proportional to the concentration of the aromatic amino acid.
Standard Solution of 0.2 -1ml is pipette out into a clean test tube. A Test solution of 0.2ml is taken into the test tube. The volume is made up to 1ml of distilled water. The Distilled water of 1ml serves as blank. To all the test tubes, 4.5ml of alkaline Copper sulfate reagent is added and incubated at room temperature for 10 minutes. In all the test tubes 0.5ml of folin's phenol reagent is added. The contents are mixed well, and the blue colour developed on the surface is read at 640 rpm after 15 minutes. From the standard graph the amount of protein in the given unknown solution can be calculated.

**4. The soxhlet method for the determination of fat**

Fat plays an important role in our food. It is an essential component that gives maximum energy. Approximately 19 Kcal energy per gram. Extra intake of fat leads to obesity and below the level lead to malnutrition. Fat nourishes the body with all the essential fatty acid that body cannot synthesise and also help in building the body.
Hence there comes the need to measure the amount of fat present in food, so that we will have an idea of its amount and accordingly we can manage our diet. It also helps in extracting all the oil present in food. There are two ways to find out the fat present in food, either by acid hydrolysis or by solvent extraction. The solvent extraction method is more pronouncedly known as Soxhlet method. It came into the scene in 1897. This method is widely used in almost all food industries and primarily used in oil extraction industries.

**4.1 Principle – Soxhlet Extraction Method**

Lipid in food present in various forms like monoglycerides, diglycerides, triglycerides and sterol and free fatty acid and phospholipid and carotenoids and fat-soluble vitamins.
Lipid is soluble in organic solvent and insoluble in water, because of this, organic solvents like hexane, petroleum ether have the ability to solubilize fat and fat is extracted from food in combination with the solvent. Later the fat is collected by evaporating the solvent. Almost all the solvent is distilled off and can be reused.

**4.2 Solvent Properties**

Primarily solvents like hexane and petroleum products are in use due to their low boiling point. In addition to it, the solvent possesses following properties:

- Distribution Coefficient: This is the ratio (at equilibrium) of the concentration of solute in the extract and raffinate phases.
- Selectivity (Separation Factor): If there are more than one solutes, then we have to for the appropriate solventdue to the chances of intermixing.
- Insolubility of Solvent: The solvent should have low solubility in the feed solution.
- Recoverability: The solvent should be thermally stable at the distillation temperature due to its volatility.
- Density: Density should be lower than water.
- Interfacial Tension: The larger the interfacial tension, the more difficult the dispersion of one liquid in the other will be.
- Chemical Reactivity: The solvent should be stable chemically and inert.
- Non-toxic

**4.3 Methodology Preparing The Sample**

First of all, the product should be dried and remove moisture in order to facilitate entry of the organic solvent, because moisture restricts the entry of organic solvent. Then size reduction is there to increase the surface area and due to it, there is larger exposed surface. After this, acidic hydrolysis which helps in breaking of protein fat emulsion and increases the availability of fat for the solvent.

**4.4 Requirements**

- Weighing balance
- Soxhlet apparatus
- Drying oven,
- Thimble
- Heating mantle,
- Glass rod
- Desiccator with silica gel,
- Petroleum ether and Cotton plugs

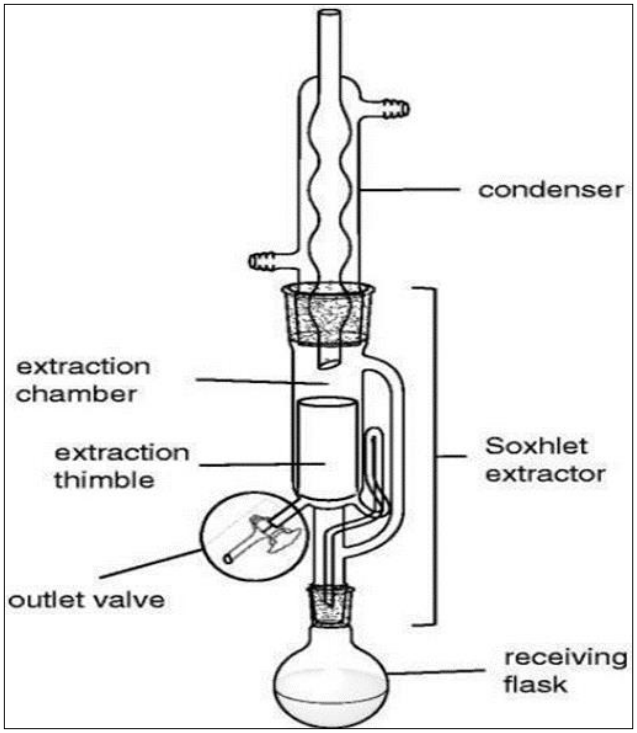


**Fig 2:** Soxhlet apparatus

**4.5 Procedure**

First of all, all the glass apparatus should be rinsed with petroleum ether and dry it in the oven at 102°c and after removing it keepin the desiccator. Fig.1. shows the soxhlet apparatus including desiccator. Weigh 5 gram of grounded and dried sample and place it in the thimble. Place the thimble in the soxhlet extractor. 150ml round bottom flask is taken and clean it and the flask is filled with 90 ml petroleum ether. The whole setting should be placed on a heating mantle and allow the petroleum ether to boil. The

extraction process should be continued for several hours, nearly for 6 hours. And then the condensing unit from extraction should be removed. Finally, it removes all the lipid. Collect almost all the solvent after distillation. The sample should placed in the oven. Then place it in the desiccator. The weight of the sample should be taken. As a result, a defat sample is obtained.

### 4.6 Calculation

Empty thimble= w1 Thimble with sample= w2 Weight of sample= p Then crude fat percentage is = (w2-w1)/p × 100

This method is an efficient method to extract all the fat present in the food. Hence it is used in oil extraction units for better recovery of oil. This method is also applied to the deoiled cake which is collected from screw impellers rather than high-pressure expression. It is also used in the analysis of fat present in the sample.

## 5. Results & Discussion

Fig 3. Represents the calcium content of sea food. It shows that the crab has the highest calcium content whereas the singhala fish has the least. The contents are described in mg.

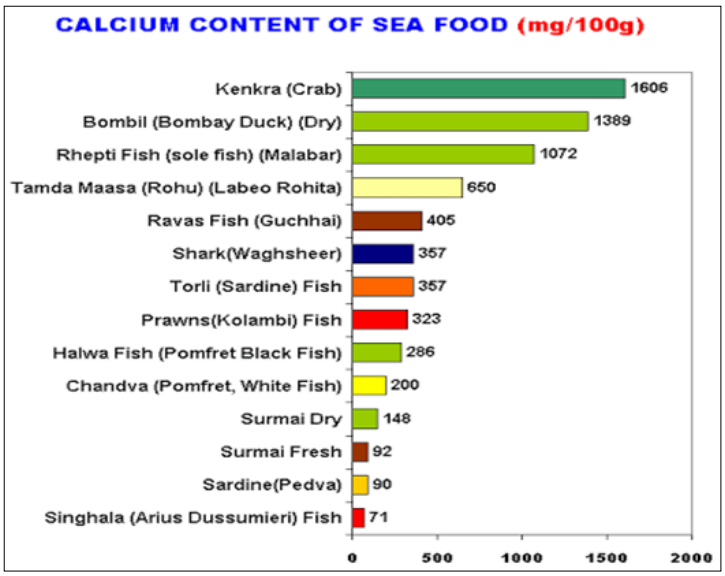


**Fig 3:** Calcium content of sea food

Fig 4. Shows about the Seafood with their nutritive contents and values The nutritive contents and values of the seafoods like calories from fat, calories, sodium, potassium, vitamin A, vitamin C, Calcium are mentioned in the fig.4.

| Seafood | Calories | Calories from Fat | Total Fat g | %DV | Saturated Fat g | %DV | Cholesterol mg | %DV | Sodium mg | %DV | Potassium mg | %DV | Total Carbohydrate g | Protein g | Vitamin A %DV | Vitamin C %DV | Calcium %DV | Iron %DV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Blue Crab | 100 | 10 | 1 | 2 | 0 | 0 | 95 | 32 | 330 | 14 | 300 | 9 | 0 | 0 | 20g | 0% | 4% | 10% | 4% |
| Catfish | 130 | 60 | 6 | 9 | 2 | 10 | 50 | 17 | 40 | 2 | 230 | 7 | 0 | 0 | 17g | 0% | 0% | 0% | 0% |
| Clams, about 12 small | 110 | 15 | 1.5 | 2 | 0 | 0 | 80 | 27 | 95 | 4 | 470 | 13 | 6 | 2 | 17g | 10% | 0% | 8% | 30% |
| Cod | 90 | 5 | 1 | 2 | 0 | 0 | 50 | 17 | 65 | 3 | 460 | 13 | 0 | 0 | 20g | 0% | 2% | 2% | 2% |
| Flounder/Sole | 100 | 15 | 1.5 | 2 | 0 | 0 | 55 | 18 | 100 | 4 | 390 | 11 | 0 | 0 | 19g | 0% | 0% | 2% | 0% |
| Haddock | 100 | 10 | 1 | 2 | 0 | 0 | 70 | 23 | 85 | 4 | 340 | 10 | 0 | 0 | 21g | 2% | 0% | 2% | 6% |
| Halibut | 120 | 15 | 2 | 3 | 0 | 0 | 40 | 13 | 60 | 3 | 500 | 14 | 0 | 0 | 23g | 4% | 0% | 2% | 6% |
| Lobster | 80 | 0 | 0.5 | 1 | 0 | 0 | 60 | 20 | 320 | 13 | 300 | 9 | 1 | 0 | 17g | 2% | 0% | 6% | 2% |
| Ocean Perch | 110 | 20 | 2 | 3 | 0.5 | 3 | 45 | 15 | 95 | 4 | 290 | 8 | 0 | 0 | 21g | 0% | 2% | 10% | 4% |
| Orange Roughy | 80 | 5 | 1 | 2 | 0 | 0 | 20 | 7 | 70 | 3 | 340 | 10 | 0 | 0 | 16g | 2% | 0% | 4% | 2% |
| Oysters, about 12 medium | 100 | 35 | 4 | 6 | 1 | 5 | 80 | 27 | 300 | 13 | 220 | 6 | 6 | 2 | 10g | 0% | 6% | 6% | 45% |
| Pollock | 90 | 10 | 1 | 2 | 0 | 0 | 80 | 27 | 110 | 5 | 370 | 11 | 0 | 0 | 20g | 2% | 0% | 0% | 2% |
| Rainbow Trout | 140 | 50 | 6 | 9 | 2 | 10 | 55 | 18 | 35 | 1 | 370 | 11 | 0 | 0 | 20g | 4% | 4% | 8% | 2% |
| Rockfish | 110 | 15 | 2 | 3 | 0 | 0 | 40 | 13 | 70 | 3 | 440 | 13 | 0 | 0 | 21g | 4% | 0% | 2% | 2% |
| Salmon, Atlantic/Coho/Sockeye/Chinook | 280 | 90 | 10 | 15 | 2 | 10 | 70 | 23 | 55 | 2 | 430 | 12 | 0 | 0 | 24g | 4% | 4% | 2% | 2% |
| Salmon, Chum/Pink | 130 | 40 | 4 | 6 | 1 | 5 | 70 | 23 | 65 | 3 | 420 | 12 | 0 | 0 | 22g | 2% | 0% | 2% | 4% |
| Scallops, about 6 large or 14 small | 140 | 10 | 1 | 2 | 0 | 0 | 65 | 22 | 310 | 13 | 430 | 12 | 5 | 2 | 27g | 2% | 0% | 4% | 14% |
| Shrimp | 100 | 10 | 1.5 | 2 | 0 | 0 | 170 | 57 | 240 | 10 | 220 | 6 | 0 | 0 | 21g | 4% | 4% | 6% | 10% |
| Swordfish | 120 | 50 | 6 | 9 | 1.5 | 8 | 40 | 13 | 100 | 4 | 310 | 9 | 0 | 0 | 16g | 2% | 2% | 0% | 6% |
| Tilapia | 110 | 20 | 2.5 | 4 | 1 | 5 | 75 | 25 | 30 | 1 | 360 | 10 | 0 | 0 | 22g | 0% | 2% | 0% | 2% |
| Tuna | 130 | 15 | 1.5 | 2 | 0 | 0 | 50 | 17 | 40 | 2 | 480 | 14 | 0 | 0 | 26g | 2% | 2% | 2% | 4% |

**Fig 4:** Nutritive contents and values of seafood

Fig. 5. shows the classification of sea organisms based on the mercury level. Various sea living organisms are tested for their mercury content and they are classified accordingly.


**Fig 5:** Mercury based classification in sea foods

**Table 6:** Nutritive content in sea food and meat

| Samples | Qty | Calories | Protein | Carbs | Fats |
|---|---|---|---|---|---|
| Beef,eye of round | 8 | 448 | 77 | 0 | 15 |
| Beef,ribeye | 8 | 521 | 63 | 0 | 29 |
| Beef liver | 8 | 382 | 58 | 10 | 10 |
| Beef top sirloin | 8 | 456 | 46 | 0 | 29 |
| Prime rib | 8 | 576 | 44 | 0 | 43 |
| Beef short sirloin T-bone | 6 | 300 | 44 | 0 | 43 |
| Lean ground beef | 7 | 526 | 56 | 0 | 32 |
| Flank Steak | 8 | 457 | 62 | 0 | 25 |
| Deli ham | 7 | 290 | 42 | 0 | 12 |
| Bison | 8 | 405 | 59 | 0 | 25 |
| Pork tenderloin | 7 | 218 | 42 | 0 | 4.5 |
| Turkey breast | 8 | 304 | 52 | 0 | 6 |
| Chicken breast | 8 | 248 | 52 | 0 | 4 |

The above mentioned figures list about the various nutritive and heavy metal contents available in the sea foods. Fig.3. describes about the calcium content present in various fish and other sea organisms. Fig.4. explains the nutritive contents and values of sea living species. Fig.4. shows the classification of sea organisms based on the mercury level. Fig.6. Gives the comparison between the seafood and meats' nutritive contents.

## 6. Conclusion

It is thereby concluded that the best steps have been taken in this project to satisfy the human needs in the upcoming future. The assurance that this project may give the detailed concept of estimating the amount of nutrition contents like protein, carbohydrates and fats in the sea food is provided. On analyzing the nutrition contents it is believed that the people may develop awareness about the depleting food sources and may ensure safe and sustainable usage of the sources thereby making the future generation to get available amount of food nutrition contents.

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