

Utilization of Laser Turbidimeter to Measure the Concentration of Starch Suspension as a Model for Measurement of Sperm Turbidity

Eryzki Triardianto, Mas Mansyur

Student of Medical Education Study Program, Faculty of Medicine, Universitas Wijaya Kusuma Surabaya, East Java, Indonesia
erikqpunya@gmail.com

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Abstract

Introduction: Turbidimeter is a tool that serves to determine or measure the level of turbidity of water. Based on the similarity in composition between starch and sperm fluid composition, such as protein, carbohydrates, fat, iron, starch suspension was chosen as a model for measuring sperm turbidity. By using a laser turbidimeter to measure the concentration of starch suspension, it is hoped that it will provide an alternative model that is appropriate for measuring sperm turbidity in the future. **Methods:** The data were processed using pearson correlation analysis by looking for the relationship between starch concentration and laser light intensity. Then performed linear regression analysis by looking for the equation of the regression line. **Objective:** This study aims to see the effectiveness of the laser Turbidimeter to measure the level of turbidity of sperm. **Results:** The highest laser intensity value is at a starch concentration of 20%, with an intensity value of 0.071. While the lowest laser intensity value is at a starch concentration of 80%, with an intensity value of 0.032. The cloudier the starch, the harder it is for the laser light to penetrate it, resulting in a lower intensity value. The results also show that the results of the pearson correlation statistic test are -0.901 and with a significance value of 0.006, or it can be interpreted as less than 0.05. **Conclusion:** With these results it can be explained that there is a relationship between starch concentration and laser light intensity. However, this study also has many shortcomings in terms of research and analysis methods. We hope that there will be further research that can be better in terms of research methods and analysis so as to produce better results.

Keywords: Laser Turbidimeter; Starch Suspension Concentration; Sperm Turbidity;

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Introduction

Currently, the use of lasers in the medical world is very rapid. Lasers in everyday life no longer sound foreign. Lasers that we know have many uses, especially in the medical world, lasers are very popular (Yolwan & Erwansyah, 2017, p. 18)

This is due to the many advantages of lasers compared to conventional therapy. Lasers were first used in medicine in the field of ophthalmology, when the ruby laser was used to coagulate the retinal arterioles causing retinopathy. Lasers are different from ordinary light. A laser is a device that contains atoms, molecules, or ions in a liquid, crystalline, or gaseous dye, when stimulated by light, chemical, gas, or electrical energy, emits a very narrow and strong beam of energy (light). These rays are coherent (the waves are synchronized well in time and space), monochromatic (consisting of one color or size), and collimated (one-way and non-divergent). Therefore, the development of lasers is currently very fast in various fields of medicine, one of which is due to the many advantages of lasers compared to conventional therapies. For example: A focused laser beam can cause evaporation of diseased tissue with an area of only one point so that trauma to the surrounding healthy tissue is minimal (Barbara & Gruendemann, 2006)

Spermatozoa or sperm cells are the result of the production of the testes consisting of several germ cells that have been ripe. Spermatozoa have three parts, consisting of a head covered by an acrosome, a middle part and a tail. The head consists mainly of the nucleus, which contains the genetic information of the sperm. The acrosome is an enzyme-filled vesicle that covers the tip of the head, used as an "enzyme drill" to penetrate the ovum. The acrosome is a modified lysosome formed by the aggregation of vesicles produced by the endoplasmic golgyriticulum complex before this organelle is removed. The acrosomal enzymes remain inactive until the sperm comes into contact with the egg when the enzymes are released. Spermatozoa mobility is produced by a long, whip-like tail whose movement is driven by energy produced by mitochondria concentrated in the middle of the sperm (Danang, 2022), (Strasinger & Di Lorenzo, 2014)

Currently, there are several methods of measuring sperm turbidity that can be used, such as: hemocytometer method, spectrophotometry method, microcell analysis, fluorescent plate reader (Kumar, Reddy, & Krishna, 2013)

To measure sperm turbidity, we can use a laser turbidimeter. Turbidimeter is a tool that serves to determine or measure the level of turbidity of water. Turbidity measurement standards began in the 1970s when the nephelometric turbidimeter was developed. A detection angle of 90E is considered the most sensitive to variations in particle size. Nephelometry has been adopted by Standard Methods as the method of choice for measuring turbidity due to the method's sensitivity, precision, and applicability over a wide range of particle sizes and concentrations (Mohd Zubir & Bashah, 2004)

Turbidity is directly proportional to concentration and thickness, but turbidity also depends on color. For smaller particles, the Tyndall ratio is proportional to the third power of the particle size and inversely proportional to the fourth power of the wavelength (Daraigan, 2006)

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In this experiment, the reason for using starch suspension was due to some similarities in composition between the starch suspension and the liquid composition. sperm. Such as protein, carbohydrates, fat and iron.

The largest content of sperm, which is ninety percent, is what is known as seminal plasma. Sperm is a reproductive cell of the male body, which was first studied in 1677 by one of the students of Antonie Van Leeuwenhoek. Laser in everyday life no longer sounds foreign. Lasers that we know have many uses, especially in the medical world, lasers are very popular (Furqoni, Yudianto, & Wardhani, 2017, p. 43). Seminal plasma is a combination of fluid that is released from accessories of male reproductive organs such as epididymis, seminal vesicles, prostate, vasa-deferentia, bulbourethral and urethral glands. Seminal plasma itself contains Citric Acid, Ascorbic Acid, Lactic Acid, Fructose, Potassium Choline Phosphate, Proteases, Amino Acids, Ergothioneine, Calcium, Spermine, Enzymes such as Fibrinogenase, Diastase, Acid & Alkaline Phosphatase, Glycosidases, a & Mannosidases a & Glucosidases, Givcouridases. Sperm fluid also contains 150 mg of protein, 11 mg of carbohydrates, 6 mg of fat, 3 mg of cholesterol, 7 percent of the US RDA for potassium, copper and zinc (Istishom & Pramesti, 2020). hile tapioca flour / starch is a food ingredient that contains 362 kilocalories of energy, protein, carbohydrates, fat, calcium, phosphorus, and iron. In addition, starch also contains vitamin A, vitamin B1 and vitamin C (Sediaoetama, 2010). On the other hand, sources also state that starch contains 362 calories per 100 grams of sample, 0.59% protein, 3.39% fat, 12.9% water and 6.99% carbohydrates (Pardianti, 2022).

Protein, carbohydrates, fat, iron, so starch suspension was chosen as a model for measuring sperm turbidity. By using a laser turbidimeter to measure the concentration of starch suspension, it is hoped that it will provide an appropriate model for measuring sperm turbidity.

Method

This research is purely experimental which is directed to find out how to use a laser turbidimeter to measure the concentration of starch suspension as a model for measuring sperm turbidity.

Laser light will be fired into the starch suspension with a predetermined concentration of starch suspension. Then the detector will capture the value of the laser intensity that has already passed through the starch suspension. After getting these data, then make a graph of the relationship between starch concentration and laser intensity which will be used as data analysis.

The data was processed using Pearson correlation analysis by looking for the relationship between starch concentration and laser light intensity. Then performed linear regression analysis by looking for the equation of the regression line.

Experimental results

This research will be conducted at the Physics Lab of Wijaya Kusuma University in January 2015.

Table 1
Results of Laser Intensity Experiments with Kanji Suspension Concentration

Experiment	Laser Intensity						
	Concentration						
	20%	30%	40%	50%	60%	70%	80%
1	0,069	0,052	0,042	0,036	0,037	0,033	0,032
2	0,071	0,053	0,044	0,041	0,040	0,034	0,035
3	0,066	0,053	0,046	0,040	0,039	0,037	0,037
4	0,069	0,051	0,039	0,044	0,042	0,045	0,034
5	0,070	0,055	0,048	0,047	0,044	0,047	0,027
Sum	0,345	0,264	0,219	0,208	0,202	0,196	0,165
Average	0,069	0,0528	0,0438	0,0416	0,0404	0,0392	0,0330

The results showed that the highest laser intensity value was at a starch concentration of 20%, with an intensity value of 0.071. While the lowest laser intensity value is at a starch concentration of 80%, with an intensity value of 0.032.

Table 2
Relationship between starch suspension concentration and laser intensity
Correlations

		X	Y
X	Pearson Correlation	1	-.901**
	Sig. (2-tailed)		.006
	N	7	7
Y	Pearson Correlation	-.901**	1
	Sig. (2-tailed)	.006	
	N	7	7

**. Correlation is significant at the 0.01 level (2-tailed).

From the results of the Pearson correlation statistical test, the correlation coefficient value is -0.901 and with a significance value of 0.006, or it can be interpreted as less than 0.05. So with these results it can be explained that there is a relationship between starch concentration and laser light intensity. The negative relationship is -0.901, indicating that the higher the concentration, the lower the intensity of the laser beam obtained.

Table 3
Regression Test Results

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.070	.006		12.263	.000
	X	-.050	.011	-.901	-4.641	.006

a. Dependent Variable: Y

The results of the regression test showed that there was an influence between starch concentration and laser light intensity. This is evidenced by the significance value of $0.006 < 0.05$.

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The graph between starch concentration and laser intensity can be seen in the image below:

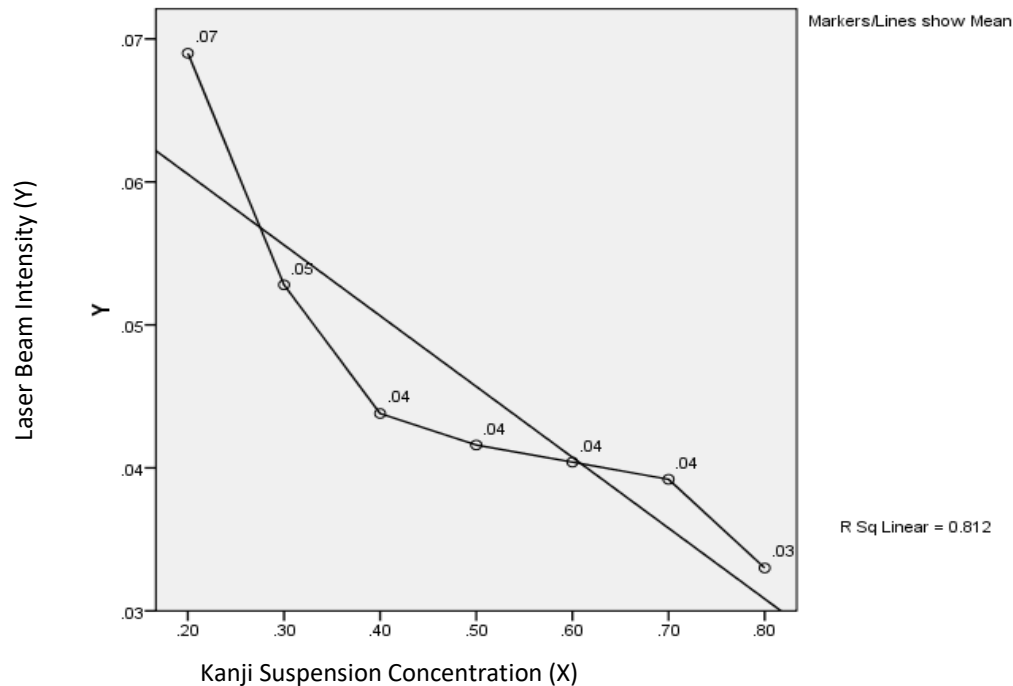


Figure 1 Graph of Relationship Between Starch Concentration and Laser Intensity

Based on the table and graphic above, the following equation can be obtained:

$$Y = a + bX$$

$$Y = 0.070 - 0.050X$$

Table 4
R Square Value

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.901 ^a	.812	.774	.00564

a. Predictors: (Constant), X

Based on the table above, can be seen that the R square value is 0.812, this indicates that the magnitude of the effect of starch concentration on the laser beam intensity is 0.812 or 81.2%. While the remaining 0.18.8% is influenced by other factors not examined.

Discussion

The results showed that there was a relationship between starch concentration and laser light intensity. The relationship is negative, meaning that the higher the concentration, the lower the value obtained. This can be proven by the highest laser intensity value being at a starch concentration of 20%, with an intensity value of 0.071. While the lowest laser intensity value is at a starch concentration of 80%, with an intensity value of 0.032. The cloudier the starch, the harder it is for the laser light to penetrate it, resulting in a lower intensity value.

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From the results of calculations using the SPSS version 16.0 program, it was obtained $r = -0.901$ and $p = 0.006$. This indicates that there is an inverse relationship between starch concentration and laser light intensity. This is in accordance with Figure 5.6 which depicts a graph of the relationship between starch concentration and laser intensity, and the linear regression equation $Y = 0.070 - 0.050X$ is obtained. From the linear regression equation, if the starch concentration is 0%, then the intensity correction factor is 0.070 W/m^2 .

Based on the results of the study, it is also known that a high starch concentration value produces a low laser light intensity and a low starch concentration value produces a high laser beam intensity. A high yield value indicates that the concentration of starch suspension is getting dilute, indicating poor sperm quality (concentration of starch suspension that is not cloudy). While the low value of the experimental results indicates that the cloudy starch suspension concentration indicates good sperm quality.

Conclusion

Based on the analysis and discussion, it can be concluded that the results of the study indicate that the highest laser intensity value is at a starch concentration of 20%, with an intensity value of 0.071. While the lowest laser intensity value is at a starch concentration of 80%, with an intensity value of 0.032. The cloudier the starch, the more difficult it will be for the laser light to penetrate it, resulting in a lower intensity value. In addition, the results of the study also show that the results of the person correlation statistical test are -0.901 and with a significance value of 0.006 , or can be interpreted as less than 0.05 .

So, with these results it can be explained that there is a relationship between starch concentration and laser light intensity. The results of the regression test also showed that there was an influence between starch concentration and the intensity of the laser beam. This is evidenced by the significance value of $0.006 < 0.05$. Based on the results of regression testing, the regression equation $Y = 0.070 - 0.050X$ is obtained.

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