Our Heritage

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An Experimental Research in Understanding Culinary Mathematical Chemistry.

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Abstract:

Culinary is related to cooking. It is an art of preparation, cooking and presentation of food, usually in the form of meals. This research provides an overview of the application of Mathematical Chemistry in Culinary and examines the results of the analyses performed in the completion of this study. The purpose of this study was to investigate which variables influence the output of the recipes by culinary chefs with respect to acidic end product or alkali end product. Data were collected and relationships among the variables were investigated by means of bivariate correlations and linear regression using the Statistical Package for the Social Sciences (PSPP) which gave the different PH value.

1.0 Introduction

Culinary Art, is an art of cooking, preparation, and presentation of food, usually in the form of end product which are termed as meals. Person working in this sector/ field are commonly known as "chefs" or "cooks", or "culinary artist" or "culinarian". This also includes Table manners or the table arts which are also known as culinary art.

Chefs do quite merely mix ingredients to create delicious meals. Indeed, an excellent cook has a lot of in common with mathematicians and scientists, as Boston Magazine noted. Thoughchefs aren't breaking down Pi or findingan associate degree of energy crisis, they still have confidence on key scientific rules or principles to perform their task or job. As much as cooking is about passion and feelings, it's conjointly concerning adhering to many key logical ideas.

In making these recipes it is noted that while adding the ingredients it is found that the end product which is made by chefs may have high level of pH level or low level of pH

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level. Thus, culinary mathematical chemistry gives us its great contribution for the better health of the society.

1.2pH Scale

1.6 Need for Study

Thus, there is a need to study the field of culinary in relation to science. The systematic approach of how Mathematical Chemistry is used in this field can be studied and analysed in relation to its pH value.

2.0 Research Methodology

2.1 Research Problem

The research problem focuses in understanding the application of Mathematics in the field of Culinary and how the mathematics concept enhances the recipes of the chefs. Thus, an attempt is made by the researcher to analyse the culinary Mathematical Chemistry.

2.2 Objective of Study

To Study the Applied Mathematical Chemistry in culinary field in relation to PH level.

2.3 Scope of Study

The scope of the current study is restricted to only two recipes. Also, the scope is restricted to observations under controlled environment.

2.4 Sampling Design

Researcher has followed simple random sampling method to collect the data using experimental method which comprises of limited sample size.

2.5 Research Design

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The research design deployed by the researcher is Exploratory, Experimental and Descriptive as well.

2.6 Research Approach

The research approach used by the research is deductive in nature.

2.7 Mathematical and Statistical Techniques

Curve Fitting and Correlation andRegression test was used to do data analysis so as to reach at the concrete conclusion.

2.8 Hypothesis Formulation

The following Hypothesis was considered based on the objective of study.

Ho: Moisture Content and pH level are not correlated with **Black Tea**.

H1: Moisture Content and pH level are correlated with **Black Tea**.

Ho: Moisture Content and pH level are not correlated with **Soda Bicarbonate**.

H1: Moisture Content and pH level are correlated with **Soda Bicarbonate**.

Ho: Moisture Content and pH level are not correlated with **Soda Bicarbonate and Tea Bag(Powder).**

H1: Moisture Content and pH level are correlated with **Soda Bicarbonate and Tea Bag(Powder).**

2.9 Limitation of Study

1)The heat and moisture transfer are one dimension.

2) The study confines to the only fewbranches of Science namely Mathematics and Chemistry.

3) Time is the major Limitation.

4) Experimental observation was under control condition.

5) Chickpeas and kidney beans were considered to be almost spHerical object.

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6) Chickpeas and kidney beanswere considered as a homogeneous isotropic solid.

3.0 Data Analysis and Findings

For the Analysis, the data was collected from the experiment conducted in control condition using Soda Bicarbonate, Tea Bag (Powder) and Both together to study the pH level of the food prepared.

Table 3.1 With Tea Bag

Pulses	Variable				
	Quantity /Kg	Moisture Content (% w.b.)	Specific Heat(kJ/^{o}c)	Density (kg/m^{3})	pH level
Chickpeas	1 tea spoon	9.78	1.376	1050.44	4.5
Kidney beans	1.5 tea spoons	13.20	1.580	1390.05	5

Source: Experimental Observations

Ho: Moisture Content and pH level are not correlated with **Black Tea**.

H1: Moisture Content and pH level are correlated with **Black Tea**.

Table 3.2 Correlations

		Moisture_Content	pH_Level
Moisture_Content	Pearson Correlation	1	1.000**
	Sig. (2-tailed)		.
	N	2	2
pH_Level	Pearson Correlation	1.000**	1
	Sig. (2-tailed)	.	
	N	2	2

Source: SPSS.** Correlation is significant at the 0.01 level (2-ailed).

Findings:

Moisture Content and pH level are correlated with **Black Tea**. Further there is perfect positive correlation between Moisture Content and pH level. And this correlation is significant at 1% LOS. This means if we use **Black Tea**to boil chick peas and beans it

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will certainly black but its pH level will increase too. Thus, leading to non-Alkaline or Acidic which is not advisable for a healthy diet.

Table 3.3 With Soda Bicarbonate

Pulses	Variable				
	Quantity /Kg	Moisture Content (% w.b.)	Specific Heat(kJ/^{o}c)	Density (kg/m^{3})	PH level
Chickpeas	2 tea bags	10.11	1.859	1284.20	8.5
Kidney beans	3 tea bags	15.60	2.145	1405.50	9

Source: Experimental Observations

Ho: Moisture Content and pH level are not correlated with **Soda Bicarbonate**.

H1: Moisture Content and pH level are correlated with **Soda Bicarbonate**.

Table 3.4 Correlations

		Moisture_Content	PH_Level
Moisture_Content	Pearson Correlation	1	1.000**
	Sig. (2-tailed)		.
	N	2	2
PH_Level	Pearson Correlation	1.000**	1
	Sig. (2-tailed)	.	
	N	2	2

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

Findings:

Moisture Content and pH level are correlated with **Soda Bicarbonate**. Further there is perfect positive correlation between Moisture Content and pH level. And this correlation is significant at 1% LOS. This means if we use **Soda Bicarbonate** to boil chick peas and beans it will certainly take less time to boil but its pH level will increase. Thus, leading to Alkaline or Non-Acidic which is advisable for a healthy diet.

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Table 3.5 With Soda Bicarbonate and Tea Bag(Powder)

Pulses		Variable				
	Quantity /Kg	Quantity /Kg	Moisture Content (% w.b.)	Specific Heat(kJ/^{o}c)	Density (kg/m^{3})	pH level
Chickpeas	1 tea spoon	2 tea bags	19.60	1.364	1600.06	7.01
Kidney beans	2 tea spoons	3 tea bags	28.50	1.232	1809.80	7.002

Source: Experimental Observations

Ho: Moisture Content and pH level are not correlated with **Soda Bicarbonate and Tea Bag(Powder).**

H1: Moisture Content and pH level are correlated with **Soda Bicarbonate and Tea Bag(Powder).**

Table 3.6 Correlations

		Moisture_Content	PH_Level
Moisture_Content	Pearson Correlation	1	1.000**
	Sig. (2-tailed)		.
	N	2	2
PH_Level	Pearson Correlation	1.000**	1
	Sig. (2-tailed)	.	
	N	2	2

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

Findings:

Moisture Content and pH level are correlated with **Black TeaandSoda Bicarbonate**. Further there is perfect positive correlation between Moisture Content and pH level. And this correlation is significant at 1% LOS. This means if we use **Black TeaandSoda Bicarbonate** to boil chick peas and beans it will certainly take less time to boil and its pH

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level will be approximately 7. Thus, leading to neutral which is advisable for a healthy diet.

3.1 Analysis of moisture content in relation with Density with Curve Fitting

3.1.1 Model Description

Model Name		MOD_1
Dependent Variable	1	Moisture
Equation	1	Cubic
Independent Variable		Density
Constant		Included
Variable Whose Values Label Observations in Plots		Unspecified
Tolerance for Entering Terms in Equations		.0001

Source: SPSS

3.1.2 Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
.989	.979	.964	1.335

Source: SPSS

3.1.3 ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Regression	245.139	2	122.569	68.760	.003
Residual	5.348	3	1.783		
Total	250.486	5			

Source: SPSS

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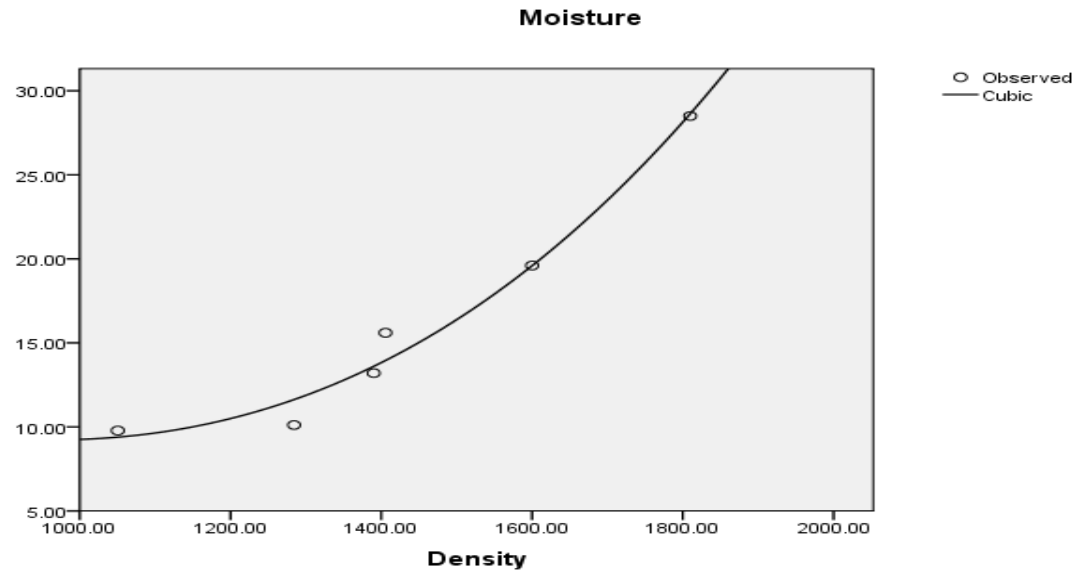

Source: SPSS

The prediction equation (Model) for predicting the moisture content in relation to Density is given bythe cubic equation $\mathbf{Y = 22.183 + 7.254*10^{-9}x^3 - 0.020x}$

The above equation was tested at 5% LOS for its prediction ability. It was found that p value is 0.03 which is less then 0.05, therefore the above equation is significant for prediction of moisture if the sheaf wants to cook concentrating on the density of the chick peas.

3.2 Analysis of moisture content in relation with Density with Curve Fitting

3.2.1 Variable Processing Summary

		Variables	
		Dependent	Independent
		Moisture	pH
Number of Positive Values		6	6
Number of Zeros		0	0
Number of Negative Values		0	0
Number of Missing Values	User-Missing	0	0
	System-Missing	0	0

Source: SPSS

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3.2.2 Model Summary

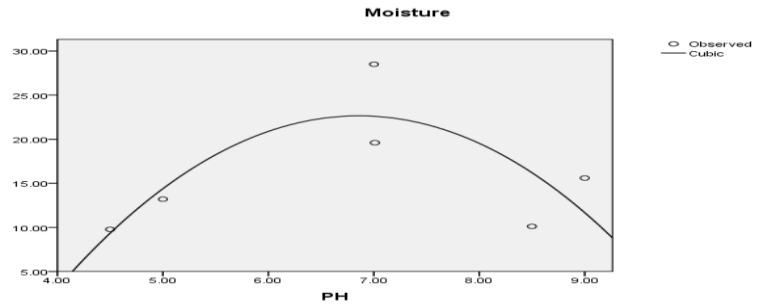
R	R Square	Adjusted R Square	Std. Error of the Estimate
.781	.609	.349	5.712

Source: SPSS

3.2.3 ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Regression	152.604	2	76.302	2.339	.244
Residual	97.883	3	32.628		
Total	250.486	5			

Source: SPSS



Source: SPSS

The prediction equation (Model) for predicting the moisture content in relation to pH is given by**y =-89.893 + 32.821x– 2.393x^2+0x^3**

The above equation was tested at 5% LOS for its prediction ability. It was found that p value is 0.244 which is more than 0.05, therefore the above equation is not significant for prediction of moisture if the sheaf wants to cook concentrating on the pH level.

4.0 Conclusion and Suggestions

4.1 Conclusion

From the analysis done in chapter 3 the researcher has made an attempt to find out the moisture level, pH level and density of chick peas while making a recipe using tea powder, soda bicarbonate and both. The result revealed that while using tea power in many recipes

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specifically in chickpeas, the end product is acidic in nature while using soda bicarbonate is alkali in nature. But when both are used end product is neutral. This signifies that the recipes which we make depends on the ingredients which are used by chefs. As the end product whatever it maybe, it should be alkali rather than acidic. Thus, the culinary person should have the knowledge of retaining the pH level to alkali or neutral with the same taste. If these precautions are taken in this industry, this will be a great contribution towards health of people.

4.2 Suggestions

At individual level one should consume alkali food rather than acidic food. Few of them are listed below.

Most Alkaline	Alkaline	Lowest Alkaline	FOOD CATEGORY	Lowest Acid	Acid	Most Acid
Stevia	Maple Syrup, Rice Syrup	Raw Honey, Raw Sugar	SWEETENERS	Processed Honey, Molasses	White Sugar, Brown Sugar	NutraSweet, Equal, Aspartame, Sweet 'N Low
Lemons, Watermelon, Limes, Grapefruit, Mangoes, Papayas	Dates, Figs, Melons, Grapes, Papaya, Kiwi, Blueberries, Apples, Pears, Raisins	Oranges, Bananas, Cherries, Pineapple, Peaches, Avocados	FRUITS	Plums, Processed Fruit Juices	Sour Cherries, Rhubarb	Blackberries, Cranberries, Prunes
Asparagus, Onions, Vegetable Juices, Parsley, Raw Spinach, Broccoli, Garlic	Okra, Squash, Green Beans, Beets, Celery, Lettuce, Zucchini, Sweet Potato, Carob	Carrots, Tomatoes, Fresh Corn, Mushrooms, Cabbage, Peas, Potato Skins, Olives	BEANS VEGETABLES LEGUMES	Cooked Spinach, Kidney Beans, String Beans	Potatoes (without skins), Pinto Beans, Navy Beans, Lima Beans	Chocolate
	Almonds	Chestnuts	NUTS SEEDS	Pumpkin Seeds, Sunflower Seeds	Pecans, Cashews	Peanuts, Walnuts
Olive Oil	Flax Seed Oil	Canola Oil	OILS	Corn Oil		
		Amaranth, Millet, Wild Rice, Quinoa	GRAINS CEREALS	Sprouted Wheat Bread, Spelt, Brown Rice	White Rice, Corn, Buckwheat, Oats, Rye	Wheat, White Flour, Pastries, Pasta
			MEATS	Venison, Cold Water Fish	Turkey, Chicken, Lamb	Beef, Pork, Shellfish
	Breast Milk	Goat Milk, Goat Cheese, Whey	EGGS DAIRY	Eggs, Butter, Yogurt, Buttermilk, Cottage Cheese	Raw Milk	Cheese, Homogenized Milk, Ice Cream
Herb Teas, Lemon Water	Green Tea	Ginger Tea	BEVERAGES	Tea	Coffee	Beer, Soft Drinks

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Source: www.indiahomeclub.com

Note that a food's acid or alkaline-forming tendency in the body has nothing to do with the actual pH of the food itself. For example, lemons are very acidic, however the end-products they produce after digestion and assimilation are alkaline so lemons are alkaline-forming in the body. Likewise, meat will test alkaline before digestion but it leaves acidic residue in the body so, like nearly all animal products, meat is classified as acid-forming.

The following food pH charts below provide some more insight into which foods are alkaline and which are acid. Each food is assigned a number which represents it's approximate relative potential of acidity (-) or alkalinity (+) present in one ounce of food. The higher the number, the better it is for you to eat.

Very Alkaline Eat More	
Vegetables	
Brussels Sprouts	+ 0.5
Peas, Ripe	+ 0.5
Asparagus	+ 1.3
Comfrey	+ 1.5
Cabbage, Green	+ 2.0
Cabbage, White	+ 3.3
Lamb's Lettuce	+ 4.8
Peas, Fresh	+ 5.1
Zucchini	+ 5.7
Cabbage, Red	+ 6.3
Rhubarb Stalks	+ 6.3
Leeks (Bulbs)	+ 7.2
Watercress	+ 7.7
Spinach	+10.0
Chives	+ 8.3
French Green Beans	+11.2
Sorrel	+11.5
Garlic	+13.2
Celery	+13.3
Cabbage Lettuce, Fresh	+14.1
Endive, Fresh	+14.5
Cayenne Pepper	+18.8

Mildly Acidic Eat sparingly	
Fruits (In Season, For Cleansing Only Or With Moderation)	
Rose Hips	-15.5
Pineapple	-12.6
Mandarin Orange	-11.5
Bananna, Ripe	-10.1
Pear	-9.9
Peach	- 9.7
Apricot	- 9.5
Papaya	- 9.4
Orange	- 9.2
Mango	- 8.7
Tangerine	- 8.5
Currant	- 8.2
Gooseberry, Ripe	- 7.7
Grape, Ripe	- 7.6
Cranberry	- 7.0
Black Currant	- 6.1
Strawberry	- 5.4
Blueberry	- 5.3
Rasberry	- 5.1
Yellow Plum	- 4.9
Italian Plum	- 4.9

Very Acidic Eat Less or Avoid	
Root Vegetables	
Stored Potatoes	+ 2.0
Meat, Poultry, And Fish	
Pork	-38.0
Veal	-35.0
Beef	-34.5
Ocean Fish	-20.0
Chicken	-18.0
Eggs	-22.0
Oysters	- 5.0
Liver	- 3.0
Organ Meats	- 3.0
Milk And Milk Products	
Hard Cheese	-18.1
Quark	-17.3
Cream	- 3.9
Homogenized Milk	- 1.0
Buttermilk	+ 1.3
Bread, Biscuits (Stored Grains/Risen Dough)	
White Bread	-10.0
White Biscuit	- 6.5
Whole-Meal Bread	- 6.5
Whole-Grain Bread	- 4.5

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Straw Grass	+21.4
Shave Grass	+21.7
Dog Grass	+22.6
Dandelion	+22.7
Kamut Grass	+27.6
Barley Grass	+28.1
Sprouted Radish Seeds	+28.4
Alfalfa Grass	+29.3
Cucumber, Fresh	+31.5
Wheat Grass	+33.8
Tomato	+13.6
Root Vegetables	
White Raddish	+ 3.1
Rutabaga	+ 3.1
Kohlrabi	+ 5.1
Horseradish	+ 6.8
Turnip	+ 8.0
Carrot	+ 9.5
Beet	+11.3
Red Radish	+16.7
Black Radish	+39.4
Fruits	
Limes	+ 8.2
Fresh Lemon	+ 9.9
Avocado (Protein)	+15.6
Non-Stored Organic Grains And Legumes	
Buckwheat Groats	+ 0.5
Spelt	+ 0.5
Lentils	+ 0.6
Lima Beans	+12.0
White Beans (Navy Beans)	+12.1
Nuts	
Brazil Nuts	+ 0.5
Almonds	+ 3.6
Seeds	

Date	-4.7
Cherry, Sweet	- 3.6
Cantaloupe	- 2.5
Red Currant	- 2.4
Fig Juice Powder	- 2.4
Grapefruit	- 1.7
Watermelon	- 1.0
Coconut, Fresh	+ 0.5
Cherry, Sour	+ 3.5
Bananna, Unripe	+4.8
Fish	
Fresh Water Fish	-11.8
Non-Stored Grains	
Brown Rice	-12.5
Wheat	-10.1
Nuts	
Walnuts	- 8.0
Macadamia Nuts	- 3.2
Hazelnuts	- 2.0
Fats	
Sunflower Oil	- 6.7
Coconut Milk	- 1.5

Rye Bread	- 2.5
Nuts	
Pistachios	- 16.6
Peanuts	-12.8
Cashews	- 9.3
Fats	
Margarine	- 7.5
Corn Oil	- 6.5
Butter	- 3.9
Sweets	
Artificial Sweetners	-26.5
Chocolate	-24.6
White Sugar	-17.6
Beet Sugar	-15.1
Molasses	-14.6
Dried Sugar Cane Juice	-18.0
Sucanat	- 9.6
Barley Malt Syrup	- 9.3
Fructose	- 9.5
Milk Sugar	- 9.4
Turbinado Sugar	- 9.5
Brown Rice Syrup	- 8.7
Honey	- 7.6
Condiments	
Ketchup	-12.4
Mayonaise	-12.5
Mustard	-19.2
Vinegar	-39.4
Beverages	
Liquor	-38.7
Wine	-16.4
Beer	-26.8
Coffee	-25.1
Fruit Juice, Packaged, Natural	- 8.7
Fruit Juice Sweetened With	-33.6

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Sesame Seeds	+ 0.5		White Sugar	
Cumin Seeds	+ 1.1		Tea (Black)	-27.1
Fennel Seeds	+ 1.3		**Miscellaneous**	
Flax Seeds	+ 1.3		Canned Foods	.
Caraway Seeds	+ 2.3		Processed Foods	.
Sunflower Seeds	+ 5.4		Microwaved Foods	.
Pumpkin Seeds	+ 5.6		**ACIDIFYING DRUGS & CHEMICALS**	
Wheat Kernel	+11.4		Aspirin	.
Fats (Fresh, Cold-Pressed Oils)			Chemicals Drugs	.
Olive Oil	+ 1.0		MedicinalDrugs	.
Borage Oil	+ 3.2		Pesticides	.
Flax Seed Oil	+ 3.5		Herbicides	.
Evening Primrose Oil	+ 4.1		Tobacco	.
Marine Lipids	+ 4.7			
Water				
Coconut Water	+ 9.04			

Source: "Back to The House of Health" by Shelley Redford Young

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