Research Paper Chemistry

Effect of Nitroglycerine on Intrinsic Viscosity of Various Salts, Sugar Solutions, Carbohydrte, Proteins, Amino Acids

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ABSTRACT

Nitroglycerine is a vasodilatator used for the treatment of anginal attacks. Nitroglycerine decreases the smooth muscle tonus of blood vessels, mainly of the veins; through the local production of nitrous oxide (NO). Nitroglycerine is very liposoluble and is readily transported through membranes. Therefore, nitroglycerine is totally absorbed by the intestinal mucosa but undergoes a massive hepatic first pass effect, rendering its oral bioavailability negligible. Sublingual, intravenous or transdermal administration of nitroglycerin partially by passes this first pass effect, allowing plasma concentration to reach the therapeutic range. Nitric oxide (NO) is a highly reactive free radical which is emerging as an important mediator in much physiological and pathophysiological process. The discovery of nitric oxide as a signaling molecule began with studies on the mechanism by which blood vessels relax and constrict, processes known as vasodilatation and vasoconstriction.

Viscosity, resistance of a fluid to a change in shape, or movement of neighbouring portions relative to one another. Viscosity is a measure of the internal friction of a liquid. As viscosity increases, the tendency to flow decreases.

In the present study we proposed to observe the effect of nitroglycerine on viscosity of various salts, sugar solutions, carbohydrate, proteins and amino acid. This Study is found to provide interesting and significant data, which possibly may have correlation with significant intrinsic viscosity by addition of various amount nitroglycerine in these solutions.

KEYWORDS : Nitric oxide, Nitroglycerine, Viscosity.

INTRODUCTION

Glyceryl trinitrate (GTN) or nitroglycerine is a nitric oxide donor used for many years as a vasodilator and for symptomatic treatment of angina. Nitric oxide is colourless gas and it is produced by various groups of enzyme termed as nitric oxide syntheses which are present in the body [1]. Nitroglycerine is a "prodrug" which undergoes complex metabolic biotransformation mostly in the smooth muscle intracellular space. This biotransformation generates to the formation of nitric oxide [2]. Nitrates producing their effect by releasing nitric oxide (NO) and this substance playing important roles in different organ systems. Nitric oxide have regulatory effects on insulin and carbohydrate metabolism,[3]. No playing a regulatory role in hypothalamus hypothesis axis and inhibition of prolactin release and regulating secretion of steroids and catecholamines [4]. Nitric oxide is highly unstable molecule and nitric oxide synthase remains effective for only few seconds (half-life is from 3-50 seconds) [5].

Viscosity is defined as the internal resistance against the free flow of a liquid to the frictional forces between the fluid layers moving over each at different velocities. Each and every liquid has its own characteristic viscosity co-efficient [6].Viscosity is a fundamental characteristic property of all liquids. When a liquid flows, it has an internal resistance to flow. Viscosity is a measure of this resistance to flow or shear. Viscosity can also be termed as a drag force and is a measure of the frictional properties of the fluid. For liquids, viscosity corresponds to the informal concept of "thickness"[7].One of the most common instruments for measuring kinematic viscosity is the glass capillary viscometer. Intrinsic viscosity is defined as the nonzero viscosity intercept extrapolated to zero concentration of solute which is a measure of the solute/solvent interaction [8]. The intrinsic viscosity, [η], is the parameter of particular interest in the viscometric study of macromolecules. For this parameter, the generally small difference between the viscosity of the solution η and that of the solvent η0 is divided by η0 to give the specific viscosity ηsp which in turn is reduced to that per unit of concentration c, of the macromolecule, ηsp /c [9].

So we had interest in observing what are the viscosity changes accompanying presence of different types of electrolytes on the viscosity patterns of NG itself. Different types of salts such as uni-univalent, uni-bivalent etc. and sugar solutions, carbohydrate, proteins, amino acids are used and effects of different amounts of NG are studied with viscosity measurements.

MATERIALS & METHODS

Chemical and Reagents: - All the chemicals used for the work are of A.R. grade of S. D. Fine Chem. Sisco.

Instruments: - Ostwald's viscometer and Electrical balance (Type Citizen CY 204).

EXPERIMENTAL

Viscosity measurements are done by Ostwald's Viscometer at room temperature (303 K). All Chemicals used were of S.D. Fine and solutions were prepared in distilled water. Standard procedures were used for measurement of viscosity (η) & specific viscosity of each solution was calculated.

To various concentration of electrolytes like Uni-uni valent, Uni –bivalent, Bi-univalent, Bi-bivalent, Tri-univalent, Tri-bivalent, Sugar Solutions like Glucose, Fructose and Amino Acid like L-Arginine are used for this work. The concentration of this solutions are (2- 10 %) dissolved in distilled water and various amount of Nitroglycerine is added in (0.5 – 2 cm3).Carbohydrate like starch, Proteins like Egg albumin, Papain, Amylase are used for this work. Amylase dissolved in approx 10-12 ml NaOH (1M), Papain dissolved in approx 20-25 ml NaOH (1M) and dissolved in distilled water. Amino Acid is prepared in (1-5%) dissolved in distilled water by addition of various volumes of NG (0.5-2 cm3) is added, Bovine Serum Albumin, Starch (1.2-2%) dissolved in distilled water by addition of various volumes of NG (0.5-2 cm3) is added. Graph is plot ηspe/C (specific viscosity/concentration) versus percentage concentration. From this measurement viscosity of NG at infinite dilution is determined with the help of graph which is used for comparison of results in various salt solutions.

RESULTS AND DISCUSSION

Table 1 gives values of viscosities obtained for various salts solutions.

Table 2 gives values of sugar Solutions, Carbohydrate, Proteins, Amino Acids.

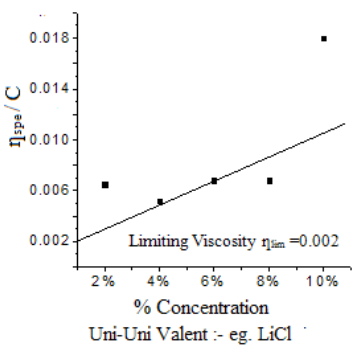
Table 1
Effect of NG on Intrinsic Viscosity of Electrolyte

Electrolytes	Blank	0.5 NG cm^3	0.1 NG cm^3	0.15 NG cm^3	0.2 NG cm^3
Uni-Univalent:-(e.g.:- LiCl)	0.002	0.0044	0.0008	0.0062	0.0031
Uni-Bivalent :-(e.g.:-K_2SO_4)	0.0052	0.0021	0.0086	0.0078	0.0086
Bi-Univalent :-(e.g.:-$CaCl_2$)	0.0029	0.0025	0.0015	0.0014	0.0018
Bi-Bivalent :-(e.g.:- $CuSO_4$)	0.0006	0.0055	0.0061	0.0057	0.0063
Tri-Univalent:-(e.g.:-$FeCl_3$)	0.0098	0.0092	0.0072	0.0078	0.0030
Tri-Bivalent :-(e.g.:-$[Al_2(SO_4)_3]$)	0.0038	0.0136	0.0146	0.0178	0.0154

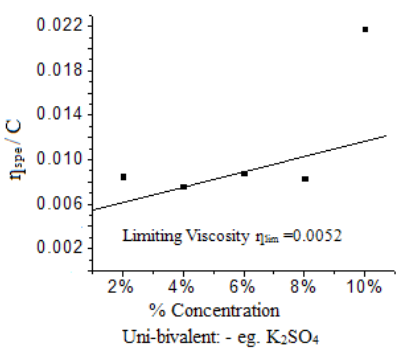
Table No.2
Effect of NG on intrinsic Viscosity of Sugar Solution, carbohydrate, Protein, Amino Acid

		Blank	0.5 NG cm^3	0.1 NG cm^3	0.15 NG cm^3	0.2 NG cm^3
Sugar Solution	Glucose	0.0088	0.0050	0.0058	0.007	0.0086
	Fructose	0.0030	0.0031	0.0048	0.0058	0.0056
Carbohydrate	Starch	0.005	0.008	0.0075	0.0065	0.0055
Proteins	Egg Albumin	0.0038	0.004	0.0058	0.004	0.003
	Bovine Serum Albumin	0.0133	0.0106	0.0078	0.0033	0.005
	Papain	0.0108	0.0103	0.0101	0.008	0.010
	Amylase	0.054	0.049	0.044	0.043	0.047
Amino Acid	Isoleucine	0.0056	0.0034	0.00016	0.0040	0.00044
	L-Arginine	0.0052	0.0032	0.0128	0.0086	0.0106

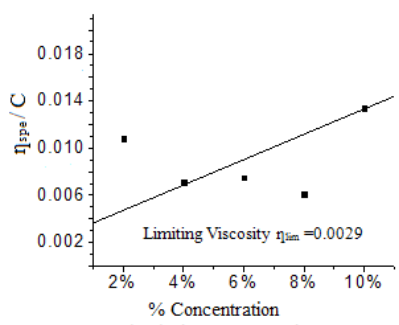
Graphical Representation:-
Following graphs gives a plot of ηspe/C (specific viscosity/concentration) versus percentage concentration.



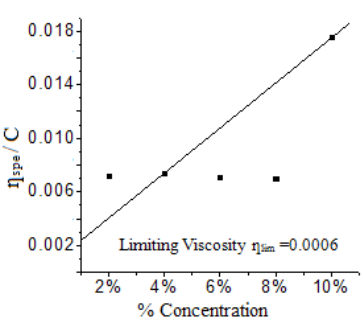
Uni-Uni Valent :- eg. LiCl
Fig No.1



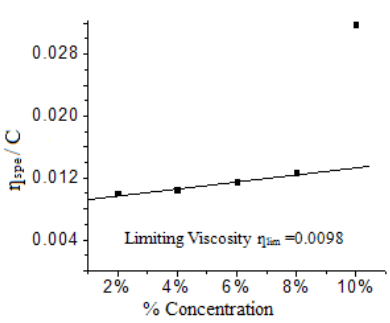
Uni-bivalent: - eg. K_2SO_4
Fig No. 2



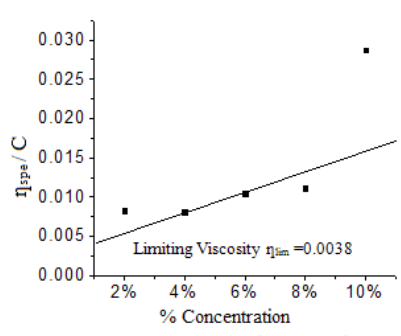
Bi-univalent: - eg. $CaCl_2$
Fig No. 3



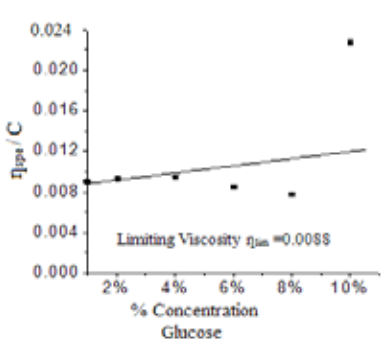
Bi-bivalent: - eg. $CuSO_4$
Fig No.4



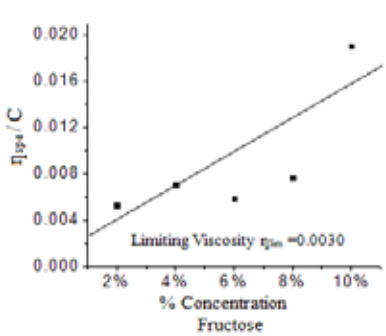
Tri-univalent: - eg. $FeCl_3$
Fig No. 5



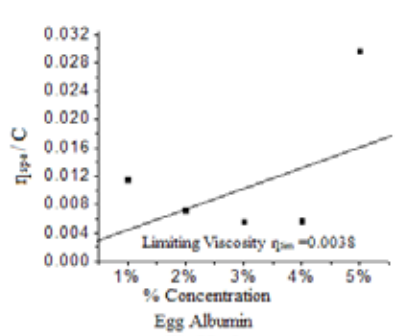
Tri-bivalent: - eg. $[Al_2(SO_4)_3]$
Fig No.6



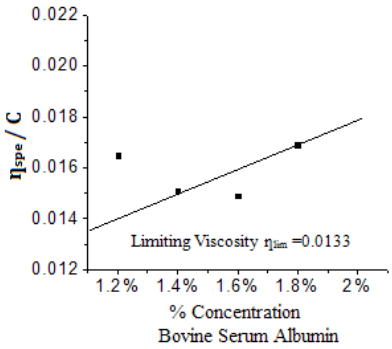
Glucose
Fig No. 7



Fructose
Fig No. 8



Egg Albumin
Fig No.9



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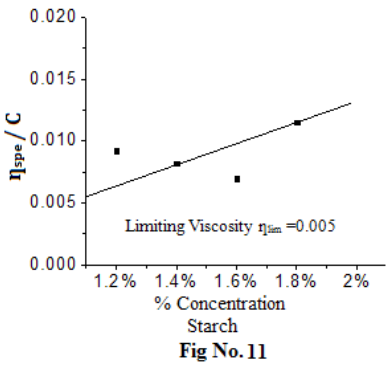

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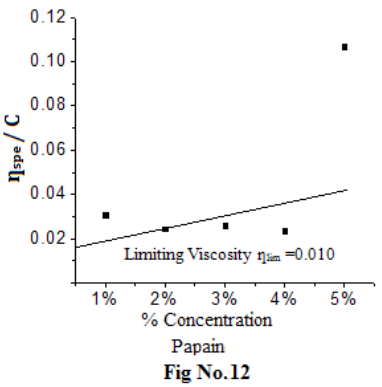

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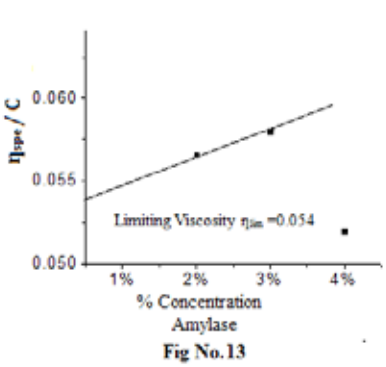

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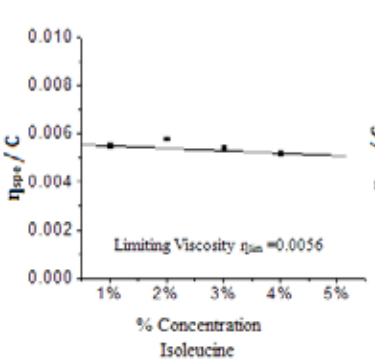

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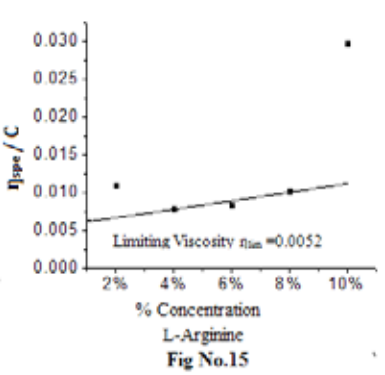
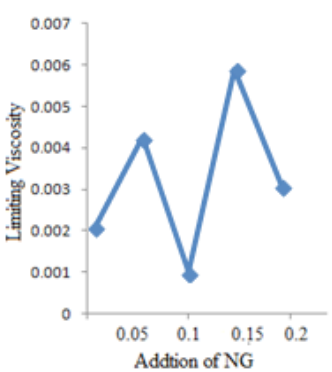
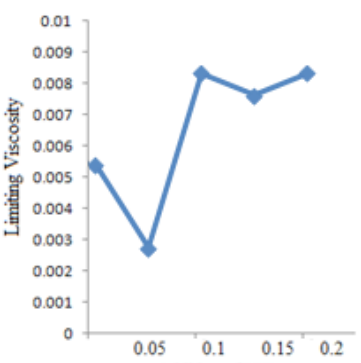


Fig No.15

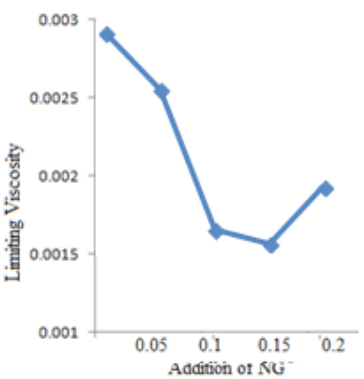
CONCLUSIONS



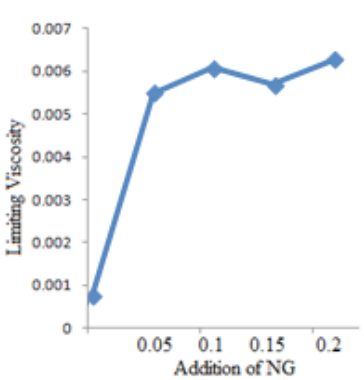
Uni-Univalent (e.g.:- LiCl)
Fig No.16



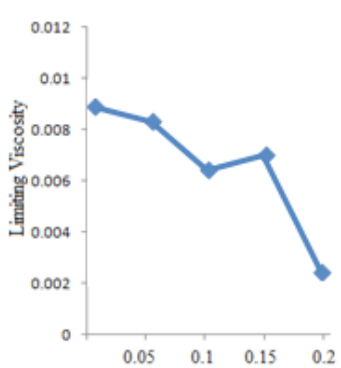
Uni-Bivalent (e.g.:-K_2SO_4)
Fig No.17



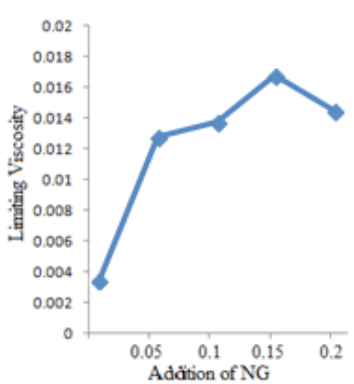
Bi-Univalent (e.g.:-$CaCl_2$)
Fig No.18



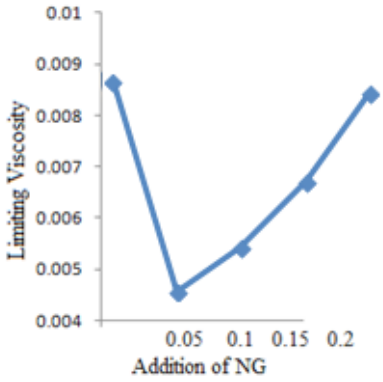
Bi-Bivalent (e.g.:- $CuSO_4$)
Fig No.19



Tri-Univalent (e.g.:-$FeCl_3$)
Fig No.20

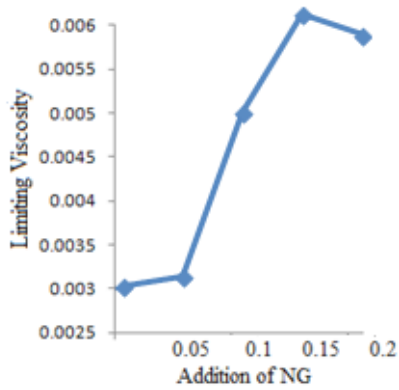


Tri-Bivalent (e.g.:-$[Al_2(SO_4)_3]$
Fig No.21



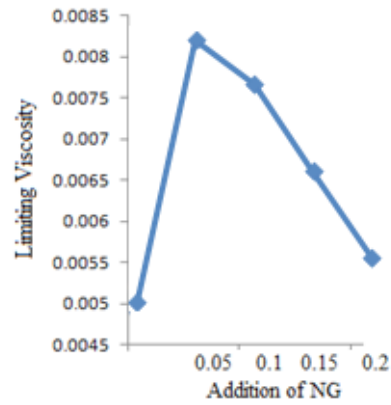
Glucose

Fig No.22



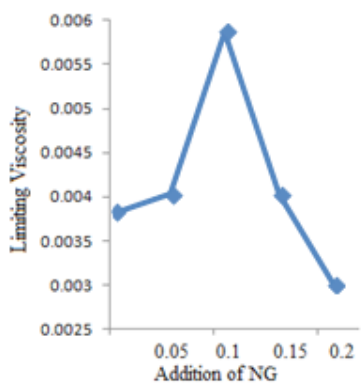
Fructose

Fig No.23



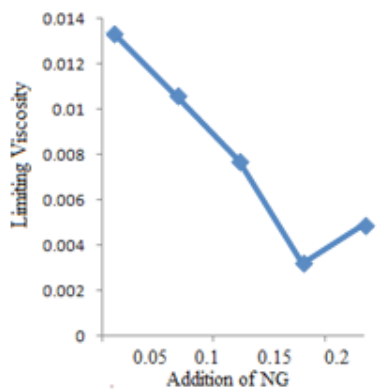
Starch

Fig No.24



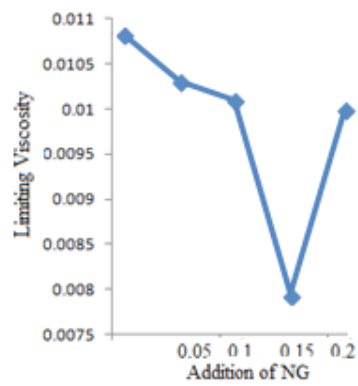
Egg Albumin

Fig No.25



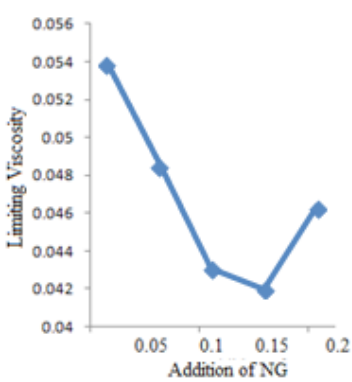
Bovin Serum Albumin

Fig No.26



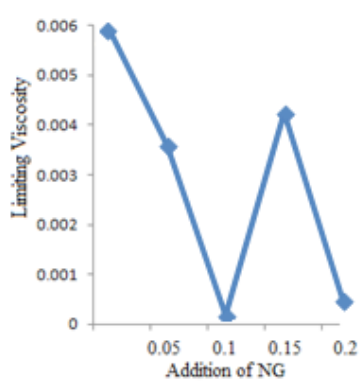
Papain

Fig No.27



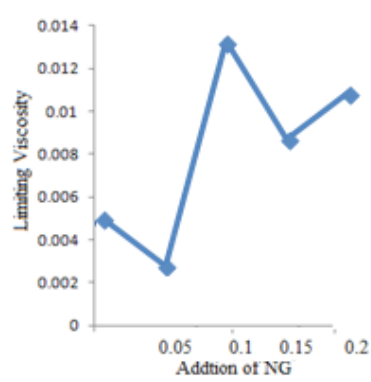
Amylase

Fig No.28



Isoleucine

Fig No.29



L-Arginine

Fig No.30

Table no.1 and 2 indicates the effect of NG on Intrinsic Viscosity of various electrolytes. The study was carried out to observe the effect of NG on different types of electrolytes one example of each type of electrolyte was taken.

For Uni-Univalent type of electrolyte no proper trend is observed between the readings for varying amount of NG. Same is the case with Uni-Bivalent and Bi-Univalent similar observations are found.

The effect of NG is much significant for Bi-Bivalent and Tri-Bivalent (CuSO4, FeCl3) as the proper increase in intrinsic viscosity is observed with increase in volumes of NG i.e.0.0006 to 0.0063 for CuSO4 and 0.0038 to 0.0154 for [Al2(SO4)3]

In Contrast for Tri-Univalent (FeCl3) –ve effect is observed i.e. intrinsic viscosity decreases with increase in volume of NG.

In case of Glucose viscosity initially decreases by addition of NG it increases it suggest that the glucose molecule assumes a simple spherical shape and flow is smooth but addition of about 0.5cm3 of NG there is sudden increase in viscosity which indicates that glucose particles are getting irregular in the shape and there is increases of resistant to flow. For Fructose viscosity is increases by addition of NG. Starch is shows the sudden increase in viscosity by addition of more NG the viscosity decreases. Egg Albumin initially viscosity increases up to 0.1cm3 addition of NG then it decreases. Bovine Serum Albumin shows decrease in their nature. In case of Papain, Amylase shows initially decrease in viscosity after addition of 0.15 cm3 it get increase. Isoleucine not shows proper trend viscosity get decrease increases again decrease manner. For L-Arginine initially it decreases and then suddenly increase by addition of 0.1cm3 NG it again decreases at 0.15

cm3 of NG then increases.

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