**CONTROL ID:** 2256553

**TITLE:** Review on hydroxylamine, a precursor to amino-acids

**ABSTRACT BODY:**

**Abstract Body:** Does life on earth come from interstellar space (IS)?

It has been recently demonstrated that part of the terrestrial water is of IS origin [Cleeves et al. Science 2014]. This raises the question whether materials like amino-acids or their pre-biotic molecular precursors could have been formed and brought to earth in the same way than water. Another question is whether these molecules were formed in the gas phase or through reactions on the surface/volume of ice-covered grains. This may then have occurred in the vicinity of proto-stellar cores or deep into a pristine dense molecular clouds at very low temperatures.

As far as bio-related molecules are concerned, chemistry with nitrogen-bearing molecules (like $NH_3$ and NO) is involved. I review recent experimental work showing that hydroxylamine ($NH_2OH$) could be formed either by surface or by volume reactions in conditions close to those prevailing in dense media. They use either electron-UV irradiation of water-ammonia ices [Zheng & Kaiser JCPA 2010] or successive hydrogenation of solid nitric oxide[Congiu, Fedoseev & al. ApJL.2012] or the simple oxidation of ammonia [He, Vidali, Lemaire & Garrod, ApJ, 2015] or the reaction of ammonia with hydroxyl radicals in a rare gas matrix [Zins & Krim, 2014, 69th ISMS]. A step further, the synthesis of the simplest amino-acids, glycine ($NH_2CH_2COOH$) and L- or D-alanine ($NH_2CH_3CHCOOH$) has already been obtained via reactions in the gas phase involving $NH_2OH^+$ [Blagojevic & al. MNRAS 2003].

In addition to several earlier models demonstrating that the formation of all these molecules is possible in the gas phase, a new recent three-phase gas-grain chemical kinetics model of hot cores [Garrod ApJ 2013] shows that the results of ammonia oxidation we obtain are plausible by surface/volume reactions.

Although none of the aforementioned molecules (except glycine in a sample of cometary origin) has been yet detected in the IS, they all are considered by many observers and modelers as likely targets of detection with ALMA.

A review of the present observational status will be presented and suggestions of conditions for future observations will be provided.

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