Major ions particle size distribution from Baia de Todos os Santos, Northeastern Brazil

G.O. da Rocha[1,2,3,]*, J.S.S. Domingos [1,3], A.C.D. Regis[1,3], J.V.S. Santos[1,3,4], J.B. de Andrade[1,2,3]

[1]Institute of Chemistry, Universidade Federal da Bahia, 40170-290, Salvador-BA, Brazil
[2] Centro Interdisciplinar de Energia e Ambiente – CIEnAm, Universidade Federal da Bahia, 40110-040, Salvador-BA, Brazil
[3] INCT for Energy & Environment, 40170-290, Salvador-BA, Brazil
[4] Instituto Federal de Educação, Ciência e Tecnologia Baiano, 45995-000, Teixeira de Freitas-BA, Brazil
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Presenting author email: giseleor@ufba.br

Organic and inorganic ions are major particulate matter (PM) constitutents, being commonly used as source tracers. They may also be good representatives of secondary atmospheric pollutants mainly associated with crustal cations (Na^+, K^+, NH_4^+, Mg^{2+} and Ca^{2+}). Furthermore, major ions are ubiquitous in atmosphere. In terms of particle's size, it is accepted the following classification particles in nuclei mode (3 nm < dp < 30 nm), nanoparticles (dp < 50 nm), accumulation mode (0.1 µm < dp < 2.5 µm) and coarse mode (2.5 µm < dp < ~100 µm). Yet PM at dp < 1 µm are also called ultrafine particles. In this study, we studied major ions size distribution from three sites in Baia de Todos os Santos (BTS).

BTS is the second largest coastal bay in Brazil (Fig. 1). Its surroundings comprises an urban area with more than 3 million inhabitants with intense vehicular and port activities and an extensive industrial area. The bay is close to a Nave Base and the largest petrochemical complex in the southern hemisphere. Although all those activities in BTS are potential sources of compounds to be realeased to atmosphere, studies about PM size distribution and the content of major ions and other species on that are scarce.

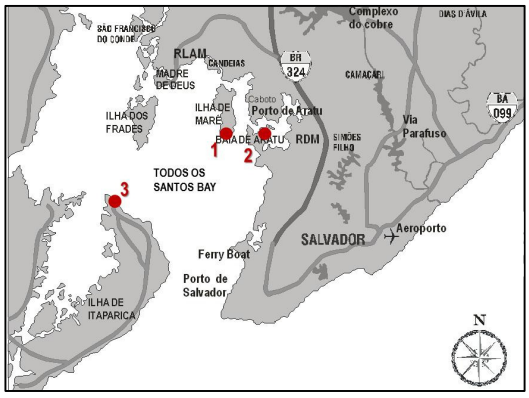

Fig. 1. Map of TSB and the three sampling sites: #1 is Botelho, #2 is Base Naval de Aratu (BNA) and #3 is Itaparica.

Samples were collected by using a NanoMOUDI sampler set with PTFE filters, at 30 L min^{-1}, during 7 days (n=2) in each site. Sampling was done during August 2010 in Botelho, September 2010 in Base Naval de Aratu (BNA), and October 2010 in Itaparica (Fig. 1). During sampling there were contributions of oceanic (90%) and continental (10%) air masses with prevailing NNE direction. Major ions analysis (F^-, Cl^-, NO_3^-, SO_4^{2-}, PO_4^{3-}, lactate, formate, acetate, succinate, oxalate, Na^+, K^+, NH_4^+, Mg^{2+}, and Ca^{2+}) was done by an ion chromatograph with conductivity detection (Domingos *et al,* 2012). Size distributions of selected ions are shown in Fig. 2.

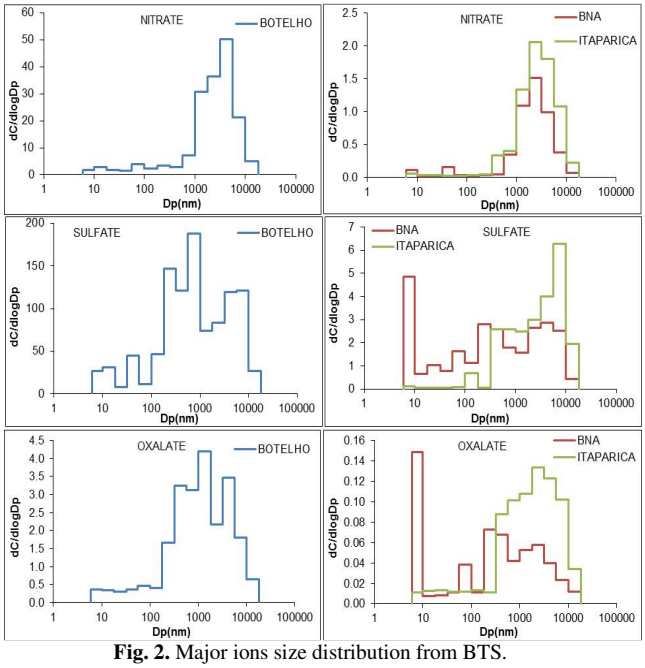

Fig. 2. Major ions size distribution from BTS.

It was observed that the ions Cl^-, NO_3^-, Na^+, K^+ and Ca^{2+} showed monomodal distribution (in the coarse fraction), SO_4^{2-}, PO_4^{3-} and oxalate had bimodal distribution (coarse fraction and in the range of accumulation), and succinate, formate, NH_4^+, Mg^{2+} and lactate showed trimodal distribution (coarse particles, nanoparticles, and accumulation mode). The species present in the coarse fraction showed biogenic sources (sea spray and resuspension of particles), while the source contributions for accumulation mode and nanoparticles were anthropogenic (fuel burning and industrial).

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