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Measuring turbidity, and indicator to evaluate drinkability of waters in Southern countries? Approaches from Burkina Faso, Sudan and Argentina case studies

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The relationship between proportion of suspended solids, dissolved oxygen and bacteriology has long been proven (Brock, 1966; Lechevallier et al., 1985; Bustina and Levallois, 2003; Chang and Liao, 2012), bacteria need coarse elements to hang on and develop. However, water bacteriology analyses are difficult to implement in southern countries. They are expensive and require sterile equipment, transport in cold conditions and a nearby laboratory, which remains difficult in remote areas under these hot latitudes. Yet, simple measurement devices allow to know in a few minutes the water turbidity.
Is turbidity an efficient tool to evaluate the drinkability of water when no bacteriological analyses are possible? The results proposed here are taken from three different studies whose purposes were to measure different physical, chemical and bacteriological parameters of water used for human and/or animal consumption. One of the finalities was to propose a method, at lower cost, to evaluate the drinkability of water for consumption.

Four case studies were chosen: the basin of the Doubegue River in Burkina Faso is a rural area of a developing country, where drinking water is taken from the alluvial aquifer close to the surface. Furthermore, the laundry is washed and the children play in running streams. Major expansion of the cultivated lands since 1980s has brought important soils losses, thus a chronicle contamination of surface water with suspended solids (Robert, 2012). The Mendoza and Tunuyán Rivers Basins in Argentina, an emerging country, have snow-glaciar regimes with naturally turbid waters. They supply drinking water to two towns, Mendoza and Tunuyán cities, respectively 1 million and 40,000 inhabitants. However, these two streams –whose watersheds are common– do not present the same managements: the Mendoza River has been equipped with large hydraulic infrastructures, moving the turbid waters into clear and erosive ones (Lavie, 2009), while the Tunuyán River and its tributaries were not transformed upstream our sample points (Lavie et al., 2013, under press). Finally, we studied an urban drinking waters network, in Khartoum, the capital of Sudan, one of the least developed countries, with chronic political crises. The nearly 6 million inhabitants of this settlement suffer many cuts and bad pressure at tap. Furthermore, Nile's waters that feed the network are summarily treated and then quite turbid, especially in summer during Nile's floods. This situation obliges the population to store and to decant water, transforming it into clear ones (Lavie and Hamza, 2013, under press).

The results of our studies demonstrate that, generally, we can observe a correlation between increasing turbidity and bacteriology, and decreasing oximetry. This assumption is disproven in many cases: (1) the stagnant waters of Khartoum and (2) the clarified Mendoza River waters. Finally, (3) the seasonal anthropogenic uses of soil and waters in the Doubegue and Tunuyán Rivers have more impact on the bacteriological quality than the natural seasonality of the suspended solids because soil erosion has increased.