Cost effective fouling control in (cooling) water intake systems with environmental and operational benefits.

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Abstract
Colonization of intake (cooling) water systems by fouling organisms is a major concern for industries, power and desalination plants over the world. Biofouling can result in increased risk of upset conditions and large operational problems, resulting in a reduction of output or even an unplanned shutdown which has high costs impact. Biofouling results in an increased wall roughness and reduction of the inner pipe diameter which leads to a significant head loss in the intake structure and requires additional pump capacity. To prevent settlement and growth of fouling species, an effective antifouling treatment is required. Worldwide, the standard industrial practice in coastal areas is application an oxidative biocide, e.g. hypochlorite, which is dosed at the water intake. Opportunities exist for science-based decisions to optimize site-specific biocide dosing regimes, that enable cost-efficient and reliable fouling control while complying to stringent regulatory discharge limits. R&D in this work field resulted in the dosing technology Pulse-Chlorination which applies a timed based on/off low level chlorine dosing regime based on the reactional patterns of local bivalve fouling species. The adaptation of this dosing technology has resulted in significant reduction of chlorine use (up to 50%) and proved to be more effective in preventing biofouling settlement in intake and cooling water systems compared to continuous and shock dosing regimes and resulted in major costs savings and consequently reduced the environmental impact significantly

Keywords
Biofouling mitigation, chlorination, environmental impact, Pulse-Chlorination

INTRODUCTION

Industries worldwide abstract enormous volumes of surface waters to cool their operation processes, e.g. power plants, (petro)chemical installations, waste incinerators, etc. In addition, desalination plants apply sea water as a source to produce potable water or process water. The larger facilities are mainly located at coastal areas using sea water for cooling or make-up water. The intake facilities can either be open, directly located on the sea shore, or using a submerged intake pipe with an intake head located below sea level. With sea water, a variety of marine fouling organisms enter the intake system, such as mussels, oysters, barnacles, etc. This type of fouling can result in major operational problems due to blockage of the cooling water system, e.g. heat exchangers. To guarantee operational reliability an effective fouling mitigation method needs to be applied, usually dosing of a biocide. To reduce the environmental impact a balanced dosing regime of biocides needs to be applied to maintain reliable plant operation. Pulse-Chlorination is a dosing method which reduces the amount of biocide dosed up to 50% and secures safe plant operation. This resulted in major operational costs savings and has proven to be a reliable dosing technique which can be applied worldwide.

BIOFOULING SETTLEMENT

Intake structures and cooling water conduits are in general ideal environments, providing optimal conditions for settlement and growth of foulers. The continuous flow of sea water provides sufficient oxygen and nutrients, the water flow is turbulent, it is dark and there are no predators.

The process for settlement starts with a chemically conditioning of the surfaces to create optimal conditions for colonization by fouling organisms in reasonably standard pattern. Firstly, organic