Integrated environmental permit through Best Available Techniques: Evaluation of the dairy industry

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ABSTRACT

Galicia (NW Spain) has been the first national milk producer with production rates oscillating between 25.7% and 39.1%, of the total milk produced in Spain between 2001 and 2014. Dairy industry is one of the most important food activities in this geographical region; only fish processing industry (data from 2014) precedes its annual turnover.

Research related to sustainability in this sector has proved that farming is the most polluting process associated to the life cycle. Nevertheless, the prevention and control of emissions to air, water and soil, as well as waste generation derived from the industrial process, cannot be omitted. This is the objective of the Directive 2010/75/EU on industrial emissions (Integrated Pollution Prevention and Control, IPPC). The industrial activities included in its Annex I (as the dairy industry) must, among others, implement the Best Available Techniques (BATs), to achieve a high level of protection of the environment taken as a whole.

This paper analyses the degree of implementation of the IPPC Directive in the dairy industry of Galicia, selecting 5 dairy industrial installations in the framework of the IPPC. The used methodology was proposed previously and applied for validation to the fish and seafood caning industry (Bello Bugallo et al., 2013). The environmental performance of these plants was analysed using, among others, the first environmental permits and taking into account the last modifications published in the official journal, as a source of information about the degree of implementation of the BAT and the associated emission levels. The results give an updated inventory of BAT for the dairy industry, the comparative between plants, the number of implemented BAT, the emissions and the overall environmental performance of each plant.

The main conclusions indicate that the degree of implementation of BAT is, in general, quite poor especially those related to waste management. The 2 plants "theoretically" with the largest number of BAT implemented are the most pollutant ones (taken into account emissions). The reason is not that BATs are not effective but every plant has its particularities (age, the kind of fuel used, and so on) and therefore, each one has its own needs from an environmental point of view. Then BAT should be selected for the most pollutant flows, the so called Improvable Flows (IF). These IF must be identified previously with adequate tools, followed by the selection of the appropriate BATs from an updated inventory. This analysis could be extrapolated and applied to the rest of the installations of this sector.

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1. Introduction

«Life cycle thinking approach considers a product's life-cycle and aims for a reduction of its cumulative environmental impacts - from the "cradle to the grave". In doing so it also aims to prevent individual parts of the life-cycle from being addressed in a way that just results in the environmental burden being shifted to another part» (European Commission, 2003).

Related to life cycle is circular economy, which drives optimal resource efficiency. It proposes a system where reuse and recycling provide substitutes to the use of raw virgin materials. By reducing our dependency on such resources, it improves our ability, and the ability of the future generations to meet their needs. The circular economy makes sustainability more likely (Sauvé et al., 2016). It is a concept that converts the vision "cradle to grave" to "cradle to cradle". As precursor of the concept of "circular economy", other

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concepts like "pollution prevention and control" have appeared, and cannot be avoided. The prevention and, where this is not possible, the reduction of the emissions in case of factories is an objective of the Industrial Emissions Directive (IED), where the dairy industrial activity is included. All the industrial processes included in the Annex I of the IED Directive, as in the previous IPPC Directive, must obtain the environmental permit. This permit includes, among others, the Emission Limit Values (ELV) for the most relevant pollutants, fixed by the authorities taking into account the Best Available Techniques (BATs). Both ELV and BAT must be checked and periodically updated, so that the latest technical developments can be considered. As Bello Bugallo et al. (2013) said, due to the difference between sectors, it is necessary to analyse the implementation of the IPPC requirements in concrete groups sharing, at least, the same technical, geographical and environmental conditions.

BATs are listed by sector in documents called Best Available Techniques Reference Document (BREF). BREF or 'BAT reference document' means a document, resulting from the exchange of information organized pursuant to Article 13 of Directive 2010/75/EU (European Union, 2010). It is drawn up for defined activities and describing, in particular: applied techniques, present emissions and consumption levels, techniques considered for the determination of best available techniques as well as BAT conclusions and any emerging techniques, giving special consideration to the criteria listed in Annex III to Directive 2010/75/EU (IPTS, 2017).

At present, many BREF are being reviewed, updated listings of BAT among other things. Another one has already been published and also BATs have been published in BATC (BAT conclusions) documents. BATC means a binding document published in the OJEU (Official Journal of the European Union), containing the parts of a BAT reference document laying down the conclusions on best available techniques, their description, information to assess their applicability, the emission levels associated with the best available techniques, associated monitoring, associated consumption levels and, where appropriate, relevant site remediation measures (IPTS, 2017). These legal documents are published like decisions of the European Commission. Only a few BATC documents are published for the moment.

Various authors have analysed the implementation and the efficiency of BAT on different industrial sectors, such as: the canning industry (Bello Bugallo et al., 2012), the textile processing industry (Karavanas et al., 2009; Schramm, 1998), the fruit and vegetable processing industry (Derden et al., 2002), the adhesives sector (Geldermann et al., 2004), sugar production (Krajnc et al., 2007), off-shore oil and gas installations (Samarakoon and Gudmestad, 2011), optimization of energy consumption in cold chambers (Alves et al., 2014), or anaerobic biofilm reactors for the treatment of dairy industry wastewater (Karadag et al., 2015). Bello Bugallo et al. (2013) determined that affected sectors need to be individually evaluated and the comparisons need to be accurately prepared because of the variability of the applicable conditions.

The reasons and the basis of the BAT selection are analysed also in Vázquez et al. (2014), Bello Bugallo et al. (2013), Generowicz et al. (2011), Samarakoon and Gudmestad (2011), Schollenberger et al. (2008), Honkasalo et al. (2005), Nicholas et al. (2000). These papers conclude that BAT selection involves identifying the most suitable system (Samarakoon and Gudmestad, 2011), for which literature provides several methodologies, like those done by Dijkmans (2000), Geldermann and Rentz (2004), Bréchet and Tulkens (2009) and Samarakoon and Gudmestad (2011), among others. Evrard et al. (2016) includes a review of the methodological approaches available in the scientific literature, to support data analysis and the decision process leading to the determination of BATs and BAT-APELs (BAT-Associated Environmental Performance

Levels).

BAT is a mature concept (it was defined for the first time in 1996 in the IPPC Directive (96/61/CE)). BAT must be continuously updated and the update must include the last technical improvements and developments. Inventories of BAT (both sectorial and horizontal) are continuously updated as in the case of this paper (moreover considering that the first revision of the BREFs has not finalized and the BATC is not available in the dairy industrial sector).

1.1. Dairy industry: life cycle thinking and IPPC

Annex I of the IPPC gathers a great variety of industrial activities, including the dairy industry, as stated in epigraph 6.4(c) "Treatment and processing of milk only, the quantity of milk received being greater than 200 t/d (average value on an annual basis)". The BREF of Food, Drink and Milk Industries that includes the dairy industry was published in 2006. It is actually under review (European Commission, 2006). The final draft will be published between the end of 2016 and 2017 (IPTS, 2015).

Several studies have proved that farming is the most polluting process associated to the life cycle in the dairy activity (Berlin and Sonesson, 2008; Djekic et al., 2014; González García et al., 2013a; Lorenzo Blanco, 2015). «The feed production (mainly fodder) and on-farm emissions derived from enteric fermentation and manure management were the highest contributing farming activities» (González-García et al., 2013b). Dairy factories activity is a potential polluting process, where water emissions are the most relevant, therefore pollution prevention and control measures must be applied.

Two methodologies have been previously proposed and used for the first time in Barros et al. (2008) and Bello Bugallo et al. (2013). Both methodologies were adapted in this work to analyse the dairy industrial sector from an IPPC point of view, and to study the degree of implementation in the Galician region, including the comparison of emissions (most of them obtained by emission factors). The implemented BAT and their influence on the overall approach that uses the legal tool provided by the IPPC Directive, the environmental permit, are determined to evaluate the main aspects it addresses. A new point is included in the analysis related to quality criteria, as a very relevant aspect for food and drink industries like dairy.

The objective of this paper is the analysis of the dairy processing activity, following the focus of the IPPC (Integrated Pollution Prevention and Control). In this framework, this work aims to analyse the degree of implementation of the IPPC Directive in the dairy industry of Galicia (NW of Spain), and compares emissions on the basis of emission factors, considering the implemented BAT and the impact on its effectiveness of more than one decade ago when the first environmental permits were approved. This can be done by looking and comparing the influence of implemented BAT on the overall environmental performance of the installations. The quality aspects that can influence the IPPC for the sector are also included in this paper.

2. Methodology

This work uses a procedure to analyse the degree of implementation of the IPPC policy in the dairy industry on the basis of pollutants emissions and the application of BAT. The steps developed in the work are described below (see Fig. 1).

1. General analysis of the dairy industry. This point gives a general vision of the dairy industry including the classification and