

# Blessed Urine – Fertile Cradle



Comments on article « Divine urine – source fertile » published in the magazine *La Maison Écologique*, Editions *Nature et Progrès*, Brussels, vol.45, June-July 2008.

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(adapted and translated by André Leguerrier)

## An environmental approach going in the wrong direction

Upon reading Julie Barbeillon's article in issue n°45 of the magazine *La Maison Écologique*, the reader will likely get an incomplete or incorrect picture about dry toilets.

When looking at the problem from a scientific point of view, you will make surprising findings about commercially available dry toilets. Once you've come to acknowledge that flush toilets are environmentally harmful, it goes without saying that the same analytical approach must be applied to dry toilets, i.e. to examine their *true environmental impact*. The present paper has one objective: explain said impact.

There is a certain parallel between the development of dry toilets and that of [bioenergy](#)<sup>1</sup> (including biofuels). At first glance, these proposed solutions seem excellent, but when delving deeper, it becomes necessary to adjust one's views to a more complex reality. For example, adopting source-separating type dry toilets and espousing the burning of « renewable » biomass to supply us with energy may appear to be steps in the right direction, but they are insufficient first steps to attain a world of sustainable development. Fixating on these first steps and not looking beyond can bar the way to a broader environmental awareness.

First, one must not underestimate the vital importance of remediating the biosphere through the setting of humus in our soils. This will determine the survival of humanity on our blue planet. There can be no sustainable food production in the world without sustainable biomass management.

## A bit of history

When in 1996, at the *Journées Information Eau* (an annual symposium on water management organized by the *École Polytechnique de Poitiers*), I exposed the disastrous ecobalance resulting from flush toilets and centralized wastewater treatment, the chairman of the plenary session pointed out the « utopia » of my words: « You would need to point a gun in a Frenchman's back to force him to sit on a dry toilet ! ». He then added that *theoretically* and *scientifically*, I was right. So in the name of pragmatism and a certain sense of reality, my proposals were dismissed. Yet from all the presentations made at the symposium, it was clear that water policies with the current technical solutions proposed are leading us into an impasse.

Although the stand taken on dry toilets by university colleagues has changed little since 1996, the public seems growingly interested in their use. Many French people use dry toilets – often going against the recommendations of regulatory authorities. Attitudes are changing. As history has so often shown, academic, political and economic decision-makers eventually end up following the lead of the most enlightened members of the public. This is how the utopias of today become the realities of tomorrow.

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<sup>1</sup> See webpage <http://www.eautarcie.org/en/07a.html> .



Over 20 years ago, François Tanguay, in his *Petit manuel de l'auto-construction* (or « Manual on building one's own home ») condemned the flush toilet emphasizing how it polluted and wasted water. Yet its harmfulness is of a different nature, as we shall see herein...

At about the same time, I launched a new type of dry toilet that I called the *Toilette à litière biomaitrisée* (or TLB), meaning « bio-controlled litter toilet », abridged as BioLitter Toilet <sup>2</sup> (or BLT in English). The idea for the name came to me at a scientific conference organized by the School of Agriculture of Ath (Belgium) in 1994 where they spoke of *élevages sur litière biomaitrisée*, or animal husbandry in [deep litter](#) <sup>3</sup> housing. I realized that the toilet I had been developing worked under the same principles as deep litter systems, starting with the graft of urea molecules and the proteinaceous content of our dejecta on cellulose polymers, a first step towards the formation of humus.

Unless I am mistaken, I was the only one to take the science of paedogenesis (or soil formation) under consideration in the life-cycle analysis of dry toilets and human dejecta. Even if in this field, certain specialists acknowledge the importance of animal dejecta for paedogenesis, when it comes to human waste, it seems that the same scientific principles no longer apply. Yet a widespread application of the *BioLitter principle* holds the key to preventing nitrate-related pollution as well as controlling the world's water problems. It is really distressing that few people are willing to consider the *coupling of animal- and plant-based biomass* as a solution to regenerating our soils.

At a 2002 meeting organized by a Brussels architect with Danish dry toilet specialists, a lively discussion ensued about the concepts of combining or separating urine and faeces. Affirmations that « animals in nature urinate and defecate in different places » evidently do not hold up in a scientific discussion. Nor does « the fertilizing power of urine collected separately ». After several hours of discussion, the Danish university colleagues came to recognize the scientific validity of my own assertions. This does not mean that they have abandoned the idea of promoting the use of source-separating dry toilets.

## Knowing what you want...

The road to Hell is paved with good intentions. The Danish colleagues' objections to the BLT were essentially due to the « constraining » aspect of using such a toilet. Quote: « Until the public finds sufficient motivation to manage a BLT, source-separating dry toilets constitute a good interim solution ».

I can admit that emptying a dry toilet receptacle every two or three days, or even every day, can be a constraint that does not sit well with everyone. What I absolutely cannot accept is that university colleagues refuse to do any research on developing a dry toilet that follows the *BioLitter principle* – the only principle that ensures the sustainable management of our waste. On the [www.eautarcie.org](http://www.eautarcie.org) website, several prospective solutions are proposed to restoring our dejecta's nitrogen and phosphorus within the cycle of soil formation.

Arguing that source-separating dry toilets are popular in Germany and Scandinavian countries does not mean that this approach is right. The burning of wood pellets and the production of

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<sup>2</sup> See webpage <http://www.eautarcie.org/en/05c.html>.

<sup>3</sup> See webpage [https://en.wikipedia.org/wiki/Deep\\_litter](https://en.wikipedia.org/wiki/Deep_litter).



biofuels are also popular, yet it is easy to demonstrate that both these examples are genuinely [harmful to the biosphere](#) <sup>4</sup> and will worsen climate effects and other such problems.

The idea of separating urine from faeces takes root in the desire to space out the intervals at which a dry toilet receptacle needs to be emptied. To do this, some have implemented clever – yet quite expensive systems – to ventilate and dry the faeces. The BioLitter Toilet requires no such system to control odours. Thanks to the urine in the toilet, the plant-based cellulose litter blocks the enzymatic reactions that generate odours. Such elemental simplicity is likely the toilet's major drawback. The more a technical solution is complicated and expensive, the more it is successful ! Even when it is ineffective. Simple inexpensive solutions are so easily dismissed.

Once you become aware of the environmental consequences of each option, the choice between the *BioLitter principle* and the separation of urine and faeces depends on one's true motivation to protect the environment. To get a clearer picture in this debate, you need to understand the impact of each type of dry toilet.

## Environmental impacts

When urine is stored (e.g. in a holding tank), urease, an enzyme that is always present in urine, hydrolyzes the urea (carbamide) to yield ammonium and carbon dioxide ions. When the urine then comes in contact with air (e.g. when it is dispersed on land, and after), an oxidation phenomenon occurs which ultimately produces ammonium nitrate as well as particularly toxic nitrite ions. Ammonium nitrate is a common fertilizer. Its presence in stored urine explains its « fertilizing » power, which presents advantages such as high agricultural yields, and yet also disadvantages such as pollution due to nitrates, nitrites and ammonium ions, thus accelerating the natural combustion of humus in the soil.

Any gardener knows that urine cannot be used pure at the foot of plants due to the risk of burning plant roots. Even source-separating dry toilet manufacturers recommend diluting urine at least 8 times before it is used in the garden. This dilution partially nullifies the proclaimed water savings achievable with source-separating dry toilets.

Dispersing urine has the same effects as spreading pig slurry on farmland. For many years, the agricultural use of slurry has been the subject of debate between herders, farmers and conservationists. No one now disputes the polluting nature of this practice. European legislators eventually decided the issue by imposing a maximum limit of about 200 kg of nitrogen (N) per hectare annually of slurry that can be spread on farmland. Since then, farmers are struggling to find land that can receive their livestock manure, while other farmers and especially environmentalists believe this limit is still too high: in the meantime, pollution continues...

But what do dry toilets have to do with this debate ? Well, from the average composition of human waste, the amount of nitrogen (N) produced by a person can easily be calculated. This value is around 5 kg of nitrogen (N) per year per person. This is obviously an average value that depends heavily on one's diet. A meat-eater will yield more nitrogen than a vegetarian. It is also known that four-fifths of our excreta's nitrogen is found precisely in urine.

To meet European standards, the dispersion of the effluent from a source-separating dry toilet would require an approximate land area of 250 m<sup>2</sup> per person. A family of 4 should therefore have

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<sup>4</sup> See webpage <http://www.eautarcie.org/en/07a.html> .



a garden of 1,000 m<sup>2</sup> <sup>5</sup>, an area which is rarely available around city dwellings. Spreading human waste in a garden that is smaller than this is not only illegal, but it is environmentally harmful. Even in a « sufficiently large » garden, pollution can occur.

But in reality, pollution is not the main problem. The organic matter contained in our excreta *should not be treated as a waste to be disposed of at all cost*. It is part of the ecosystem that provides our food. Restoring this precious matter to the biosphere necessarily requires proper composting, which needs large quantities of carbon-based plant cellulose to get a carbon/nitrogen ratio (C/N) of 60. In addition, nitrogen-based animal biomass (including human dejecta) must come in contact with plant cellulose polymers as soon as possible after dejecta are produced, before the various enzymes that mineralize nitrogen and phosphorus (and emit odours) come into play. Storing urine (and withholding it from the composting process) partly removes its organic nitrogen from the humus-forming process. *The main problem with flush toilets and source-separating toilets is not pollution: it is the destruction of organic matter and its subtraction from the great natural cycles.*

Another environmental impact of source-separating dry toilets is the electricity needed for ventilation (and sometimes heating) to dry faeces. Also, proponents of these toilets tend to qualify dried faeces as « compost », which reveals the extent of their ignorance about soil formation. If no combined composting of cellulosic litter with our dejecta occurs, using a source-separating dry toilet is equivalent to defecating directly in the garden.

## Our dejecta: a negligible quantity?

It is often argued that agriculture is the major vector of nitrogen pollution when compared to household sewage. This may be true in some instances, but at a planetary scale, it is no longer true.

A 2000 study published at the *Université de Louvain* in Belgium <sup>6</sup> cites information of critical importance: the nitrogen contained in human dejecta is equivalent to about 40% of the nitrogen used in agriculture, worldwide. Currently, the figure is probably higher. In the context of sustainable development, we can no longer afford the luxury of destroying our dejecta's organic matter for purposes of wastewater purification (even by way of phytoremediation) or to be used as fertilizer in the same way as synthetic fertilizers and pig slurry. (In fact, source-separating dry toilets tend to be used this way, as a source of fertilizer.)

Each kilogram of animal/human-based and plant-based organic matter is necessary to help maintain the humic structure of farmland soils. It's not even a question of fertilization : it's a question of sustaining an activity that nourishes humanity.

## The BioLitter principle: towards a sustainable world

The situation is different when applying the *BioLitter principle*, i.e. promptly coupling animal/human-based nitrogen matter with plant-based carbon matter. Urea and other organic nitrogen compounds are thereby directly fixed, chemically, on the carbonaceous cellulose. Thereafter, the enzymes that would normally mineralize the nitrogen compounds no longer have access to said compounds. When correctly composted, our dejecta's nitrogen and phosphorus enter the process

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<sup>5</sup> Update 2012-08-12 : The original text carried higher figures. The corrected figures were pointed out to the magazine's editors who did not publish them.

<sup>6</sup> Bertagila M., *Séminaire en pollution de l'environnement 1998-99* (Seminar on environmental pollution). *Université Catholique de Louvain* (UCL), Belgium, Biological Engineering Unit.



of humus formation, instead of being converted into fertilizer and pollution. Nitrogen loss is minimal and pollution is practically nonexistent, even within a compost heap (that is properly managed).

To apply the *BioLitter principle* in urban areas, dry toilets are not absolutely necessary. You need only abandon all-mains sewerage <sup>7</sup>. Low-flush toilets would discharge the organic waste in a separate sewer system reserved for such waste. The toilet effluent could be used to impregnate a matrix of cellulosic litter in collective centralized facilities. This litter could be made up of green city waste (e.g. from parks maintenance), shredded cardboard (e.g. from packaging), soiled paper waste, etc. You could also include forestry waste and household organic waste (representing 40-45% of total urban waste). The remaining urban waste (including plastics) could then more easily be recycled, even to produce energy <sup>8</sup>. With today's knowledge, applying the *BioLitter principle* <sup>9</sup> seems to be an *inescapable* option to build a sustainable world. In such a world, conventional sanitation and current flush toilets (as well as source-separating dry toilets) have no place.

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Mons (Belgium), June 18 2008

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<sup>7</sup> Update 2013-04-06 : the original version of the present document recommended the implementation of a new type of toilet that we had coined [turbo-toilets or TTs](http://www.eautarcie.org/en/05c.html#six) (see <http://www.eautarcie.org/en/05c.html#six>), without source-separating the urine. However, since 2011 ongoing experiments in Hungary on heating the home with a humanure (human dejecta) composting system have revealed that it is necessary to add a bit of water to dejecta. Thus, the concept of the turbo-toilet has been abandoned in favor of « off-the-shelf » low-flow toilets or micro-flush toilets.

<sup>8</sup> The presence of wet organic matter in our city waste, when incinerated, greatly reduces the quantity of energy recoverable.

<sup>9</sup> This constitutes the basis of an ecological sanitation system we have coined [SAINECO](http://www.eautarcie.org/en/02a.html) (see <http://www.eautarcie.org/en/02a.html>), or EAUTARCIE's version of ECOSAN.