

# An Interview with Nicotine Expert Dr Jacques Le Houezec On Eliquid: Storage, Safety and More.

**Neurologist Dr Jacques Le Houezec is the Honorary Lecturer, UK Centre for Tobacco Control Studies, University of Nottingham, England, a founder member of The Society for Research on Nicotine and Tobacco and manager of [treatobacco.net](http://treatobacco.net). You can find him blogging at [Le Blog de Jacques Le Houezec](http://Le Blog de Jacques Le Houezec).**



## **Eliquid and Addiction**

**JD:** One of most fascinating possibilities to emerge recently is the suggestion that nicotine on it's own may not be as addictive as cigarettes.

While I'm aware we probably need more evidence of this, are you of the opinion that nicotine on its own could be less addictive than smoking?

**JLH:** According to some evidence from surveys of e-cig users (Farsalinos et al., Dawkins et al.) it seems that vapers feel less dependent from e-cig than they used to be from smoking.

With time, they tend to use lower levels of nicotine concentration in the e-liquid they use, and they rate themselves as less addicted on dependence scales. This could be supported by a recent study in rats, showing that total tobacco extract, particularly when extracted from roll-your-own tobacco (more than cigarette tobacco) seems more addictive in rat self-administering it than pure nicotine.

**JD:** Has nicotine's capacity to create addiction been tested in a clinical trial, and if so what were the results?

**JLH:** No, this would be unethical. You cannot test this in non smokers. Except when testing for nicotine beneficial effects in some medical conditions. It has been tested in depression or Parkinson disease, and it didn't seemed to create an appetite for nicotine in these subjects. But these studies were quite small in terms of number of subjects involved, so it is not sufficient to call it an evidence.

**JD:** If so, what other ingredients in a cigarette/aspects of smoking could contribute towards addiction?

**JLH:** We know that other substances in tobacco smoke (e.g. MAOI which have antidepressive effects) probably act in synergy with nicotine, and make it more addictive.

## **Dangers of Nicotine Usage**

**JD:** You've said in the past that nicotine isn't as dangerous as previously believed. (See How much eliquid does it take to kill you?)

As we can't test lethal nicotine doses on actual people, how can we be sure about new estimates?

**JLH:** Because these calculations were done by using clinical data from accidental or voluntary (suicide attempts) nicotine ingestions or administrations. The most recent case reported an ingestion of 1500 mg of nicotine with no fatal issue. To be prudent, a review paper from Bernt Mayer, an Austrian pharmacologist, stated that the actual lethal dose is at least 500 to 1000 mg.



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**JD:** Obviously, people don't want to experience any serious adverse effects from nicotine. How much nicotine (mg/kilo) would a tolerant user have to use before experiencing a serious adverse effect?

**JLH:** When you inhale nicotine, with cigarettes or e-cigarettes, there is no concern of overdosing.

Smokers and vapers know exactly the dose they need, and can regulate their intake on a puff by puff basis. The first symptom of overdosing is nausea, all smokers, and even adolescents who try smoking or vaping, will feel sick if they take too much nicotine, and they just stop taking it!

**JD:** We've heard of people being sick after eating a cigarette. Is this due to the nicotine in the cigarette, or due to other ingredients??

**JLH:** Yes, mostly because of nicotine, as I just said. Nicotine triggers nausea, and vomiting centers in the nervous system.

**JD:** There remains a perception among many people that nicotine is the cause of smoking diseases. Obviously, nicotine isn't as bad as nicotine with tar and the carcinogens caused by smoking cigarettes, but what long term dangers does it carry, and how bad is it when compared to smoking?

**JLH:** Nicotine itself is not causing harm, particularly in people used to it like smokers. They become rapidly tolerant to its effects. The only remaining question is what long-term effects of inhaling pure nicotine could cause. We don't have the answer yet in humans, even if some vapers are using it for many years now. To date we have not seen any adverse effect.

But we have some evidence from a study in rats, that exposed them to pure nicotine inhalation for 2 years (equivalent to a human life for a rat). The results showed no adverse effects on any organ (no carcinogenic effect, no pulmonary effects, no cardiovascular effects). The only difference noted between rats who were exposed to nicotine and control rats, was that nicotine exposed rats weighed less than control rats. This is also the case in smokers as we know, they weigh less than they would weigh as non smokers.

**JD:** Anti-smoking campaigner Stanton Glatz has argued that exhaled vapour is dangerous to non-users of e-cigarettes.

Can we quantify the danger of nicotine exposure from e-cigarettes to non-users?

**JLH:** If any, it would be very small. The amounts of nicotine released in the air by vapers is very small. And no one, even non smokers, can avoid nicotine exposure. There is nicotine in some vegetables from the same family of tobacco, it is the case of tomatoes, potatoes, eggplants... In any case, this should not be a public health concern.

## Storing Eliquid

**JD:** What's the safest storage method for e-liquid (and is it okay to freeze it?)

**JLH:** First of all keep it away from light and air as much as possible, because it causes nicotine to oxidise, changing its colour, but not changing its properties. Keeping it in the fridge or freezing it is fine.

Nicotine is quite stable even when frozen (this is how it is done in clinical studies when someone wants to assay nicotine in the blood of subjects for example).

**JD:** How fast is the decay rate of e-liquid, and how long is it safe to store e-liquid for?

**JLH:** For e-liquids I would be more concerned about the flavours. They certainly degrade faster than nicotine. On current e-liquids it is stated that they can usually be used for a year.

But if frozen, they certainly can be stored longer. I am confident that studies are or will be conducted soon to answer this question.



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**JD:** Old e-liquid can get a peppery taste. Is it still safe to use?

**JLH:** This is probably due to the degradation of flavours. The pepper taste is the one of nicotine itself, if flavours are degraded, then only the taste of nicotine persists.

**JD:** We know that e-liquid can change colour with different food flavourings, light exposures e.t.c. – sometimes going dark, and sometimes going yellow.

What causes this, and is there any need for vapers to be concerned when this happens?

**JLH:** As I said above, this is due to light and air oxidation, it could change the taste, but should not change the effects. Some flavours, particularly tobacco flavours, or chocolate or coffee, can also turn dark with time, probably for the same reasons. This should not be a concern, but I would recommend to keep them cool and away from light.

### **Benefits of Vaping and Nicotine Use**

**JD:** What, if any, benefits does nicotine have?

**JLH:** Nicotine is a stimulant, like caffeine, it helps keeping alert. But nicotine has also other properties that we know more or less well. They are nicotine receptors everywhere in the body, including the digestive tract, but the most important are in the brain, and they interact with many neurotransmitters systems (the chemistry of the brain).

It has been shown that nicotine can help in many conditions (e.g. depression, Parkinson disease, Schizophrenia...), but it has not been studied extensively, there is a clear need for more research. The main problem is that nicotine cannot be patented, it is a natural substance, so one would need to use a modified molecule, close enough to nicotine, to obtain the desired effect, and then to do clinical studies to demonstrate its effect. The pharmaceutical industry has not been very active in this domain despite some encouragements from researchers.

### **Types of Nicotine**

**JD:** What is the difference between pharmaceutical grade, non-pharmaceutical grade nicotine and pesticide grade nicotine, and how important is it to use pharmaceutical grade nicotine?

**JLH:** Nicotine, for whatever purpose, is always extracted from tobacco, because it is the cheapest way of getting it. Because nicotine is an alkaloid (like caffeine, cocaine, curare, etc.), and that there is many other alkaloids in tobacco, it is difficult to obtain 100% pure nicotine. There is always a small amount of impurities, even in the best pharmaceutical grade nicotine. So, currently this is the best product that can be used, and it should be used for e-liquids to obtain the safest product as possible.

**JD:** Is there any difference between nicotine derived from tobacco plants and those derived from other sources?

**JLH:** No, nicotine is nicotine, wherever it comes from, but tobacco is the plant that produces it in the largest quantities.

### **Eliquid Flavourings**

**JF:** As flavouring alters the ph level of nicotine, what is the most effective way of testing nicotine levels in eliquid with flavourings?

**JLH:** Flavourings are used in very small quantities in e-liquids, this should not alter the pH, in my opinion, but other experts may have a different view on this, I am not a chemist.

### **Nicotine Metabolites:**

**JD:** What metabolites of nicotine re formed within the body, after it has been metabolised.

**JLH:** There are different metabolites, but the most important one, in quantities, is cotinine which has almost no pharmacological properties, at least in terms of addiction. Nicotine is transformed into cotinine for about 70-80%, the rest of the metabolites represent small amounts.



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## Vaping Politics and the EUEcigBan

**JD:** With e-cigarettes, we can't get away from the political aspect!

Despite numerous scientists declaring e-cigarettes are orders of magnitude safer than smoking, most countries, including the UK and the EU, are trying to ban them (see The EUEcigBan). What do you think is behind these bans?.

**JLH:** What I fear most is the lack of knowledge and the misconceptions about nicotine from the politicians, but also from some health professionals and tobacco control advocates. To me this is what is at stake here. There is a great need for education about nicotine.

Obviously, there are also lobbies who are actively misrepresenting e-cigarettes because of their own agenda.



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