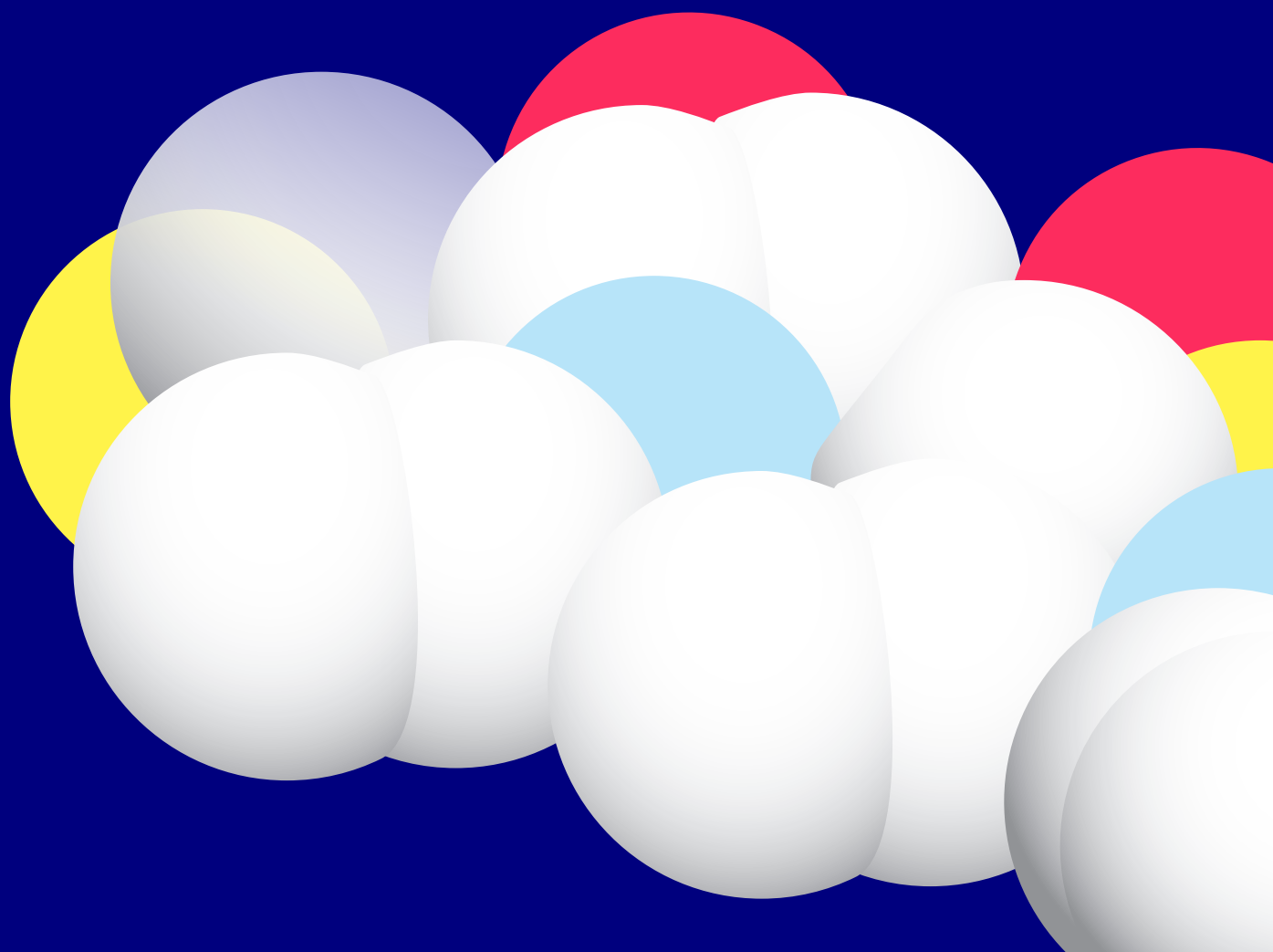


Scitegrity

# Solving the challenge of Tariff coding Chemicals

Automatic HS / commodity coding for chapters  
28 and 29



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# Solving the challenge of Chapters 28 & 29: Automated HS coding for chemicals

Every day, millions of tonnes of chemicals are bought, sold, distributed and delivered across the world – a process that’s regulated by Chapters 28 and 29 of the World Customs Organization (WCO) Harmonized System (HS).

**Each of the vast number of chemical compounds needs an appropriate HS (also known as a commodity code) before it’s traded and transported. A HS code is essential for calculating tax and duty for any chemical or commodity that crosses borders.**

Obtaining the right HS code is critical to compliance but, too often, the responsibility for navigating this complex and highly-detailed guidance is given to those with limited scientific knowledge. This can lead to avoidable errors in coding that can cost businesses tens of thousands of dollars in unnecessary taxes every year.

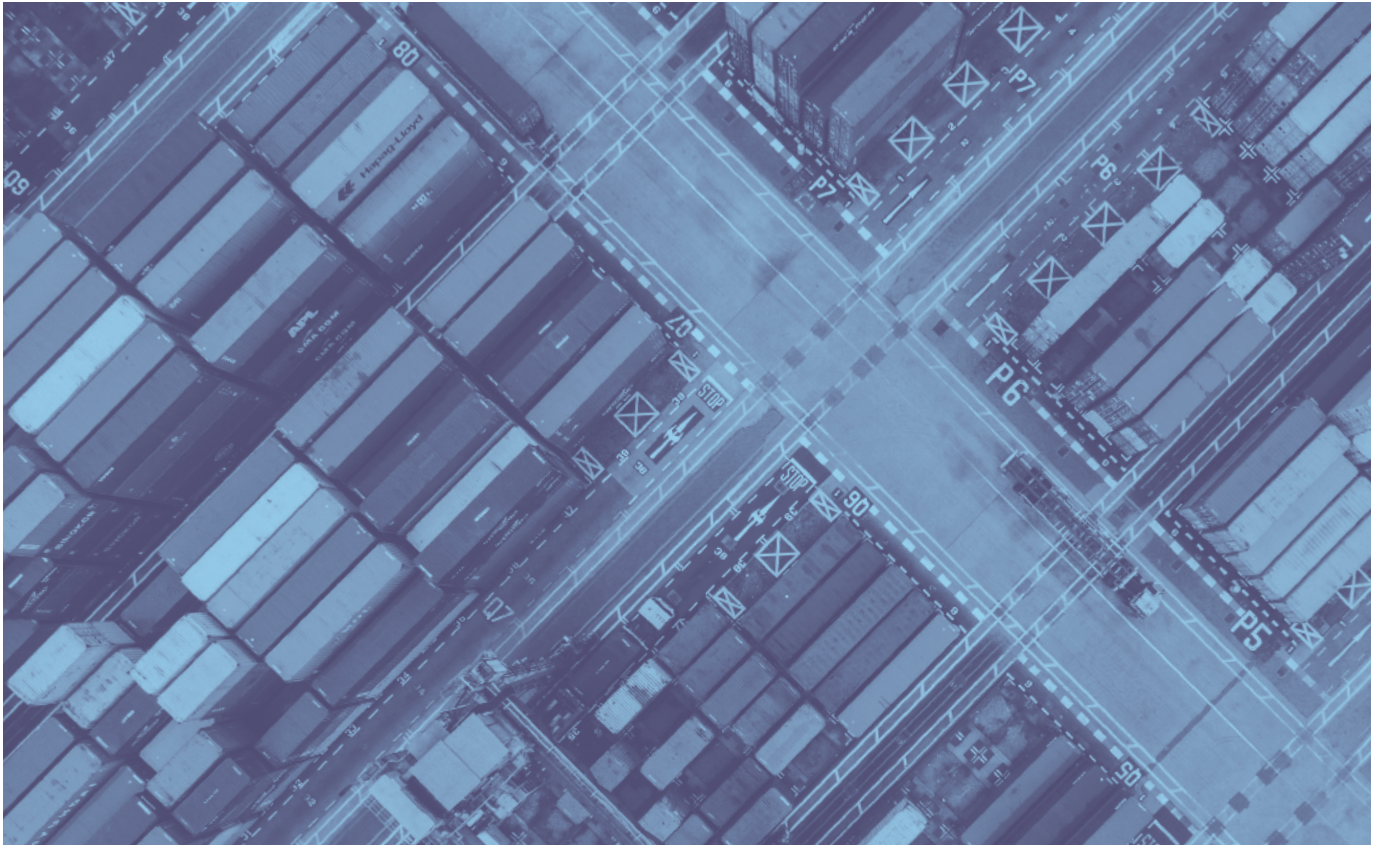
In this white paper, we discuss the challenges of tariff-coding organic and inorganic chemicals and present ExpediChem, a new cloud-based platform which enables non-chemists to generate accurate HS codes and duty calculations for common and novel/proprietary chemicals in seconds.

With ExpediChem, scientists and non-scientists can rapidly identify the correct HS code, reducing delays, saving money and increasing regulatory compliance – solving the challenge of Chapters 28 and 29.



“A simple, intuitive way to allow non-chemists to correctly HS code chemicals, reducing delays, saving money and increasing regulatory compliance”





## What are Chapters 28 and 29?

The global trade in organic chemicals is massive. A European Union report found that organic chemicals represent 3% (by value) of all imports into the EU, representing billions of dollars worth of trade and taxes.<sup>1</sup>

The international market for chemicals and compounds is regulated by the World Customs Organization (WCO) Harmonized System (HS). The extensive guidelines have been designed to standardise and simplify cross-border trade in goods and chemicals. Of all the chapters and commodity types covered by the Harmonized System, Chapter 29 (organic chemicals) and Chapter 28 (inorganic chemicals) are widely considered to be the hardest to follow, and the most difficult to apply. Chapter 29 is extensive, running to hundreds of pages. It's further complicated by extensive explanatory notes that must also be considered and

understood.

The challenge of finding the right HS code doesn't stop there. Both the Pharmaceutical Appendix and the US-specific Chemical Appendix can alter the HS code or rates of duty to be declared, making the process more costly, complicated and time-consuming for businesses.



“In the USA implementation of the harmonized system (HTSUS), organic chemicals are covered by over 170 pages of complex rules relating to chemical structures and classes”

# The challenge of coding chemicals

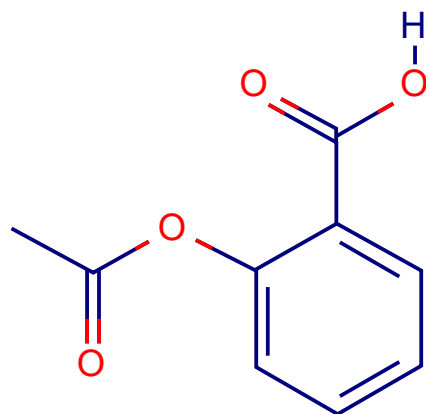
Identifying the correct HS code requires a comprehensive knowledge of chemistry and an in-depth knowledge of the rules, regulations and permutations of Chapters 28 and 29.

**In the simplest of cases, you may have a CAS RN® (Chemical Abstracts Service Registry Number), that you can use in one of the available lookup systems, such as ECICS in the EU.<sup>2</sup>**

However, such systems only cover a tiny percentage of traded chemicals. ECICS itself contains approximately 35,000 chemicals and 48,000 CAS RNs, but tens of millions of commercially available chemicals are traded worldwide. The Available Chemicals Directory alone lists over 11.7 million chemicals for sale.

Even if you are lucky enough to be shipping a common chemical, classification can still be difficult. A single chemical structure can be known by hundreds of different names, numbers and identifiers, but only cited as one or two names/identifiers in Chapters 28 & 29.

**Take the chemical structure below:**



This is the chemical structure for aspirin. Its Pubchem record lists over 400 different names, including aspirin, acetylsalicylic acid, 50-78-2, 2-Acetoxybenzoic acid, 2-(Acetyloxy)benzoic acid, O-Acetylsalicylic acid and o-Acetoxybenzoic acid.<sup>3</sup>

If you search for it using CAS number 50-78-2 in the HTSUS Chapter 29, you won't find it. Only two, of the 400 names aspirin is known by, are listed in the HTSUS.

If you've developed a new or proprietary chemical, it's your responsibility to determine the most applicable HS code and duty. Typically, chemicals are manually coded in-house against the complex chemical rules of Chapters 28 and 29 to determine the appropriate designation – a process that is prone to error.

Manually coding a new chemical is labour intensive and should only be completed by qualified and experienced chemists. External consultants can be used, but costs can quickly stack up.

Trade compliance lawyers or other specialists can charge between \$200 and \$800 per hour. Identifying the appropriate HS code for a single chemical is typically set at 1 – 2 hours of work and can take a few days to turn around. If you're shipping multiple chemicals or proprietary compounds at the same time, costs can rapidly increase.

If you're willing to wait for a result, you can disclose the structure to an official customs lab or authority for a determination.<sup>4</sup> The process can take weeks or even months, leaving you with no option but to pause what you're doing until a response is delivered.

But there is an alternative. ExpediChem is a highly accurate and completely automated system that can determine the HS code for any organic chemical covered in Chapters 28 and 29 of the HTSUS (US import), Schedule B (US export), the UK, EU and China. Created by scientists for non-scientists, it's a simple-to-use online platform



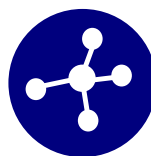
“Easily HS-code chemicals in seconds, even novel and proprietary ones”



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## The solution: Searching with the structure

The limitations of searching for a chemical by name alone are widely understood and acknowledged. It's now common practice to perform chemically enabled searches, where you search for the molecular structure of a chemical against databases or rule sets.



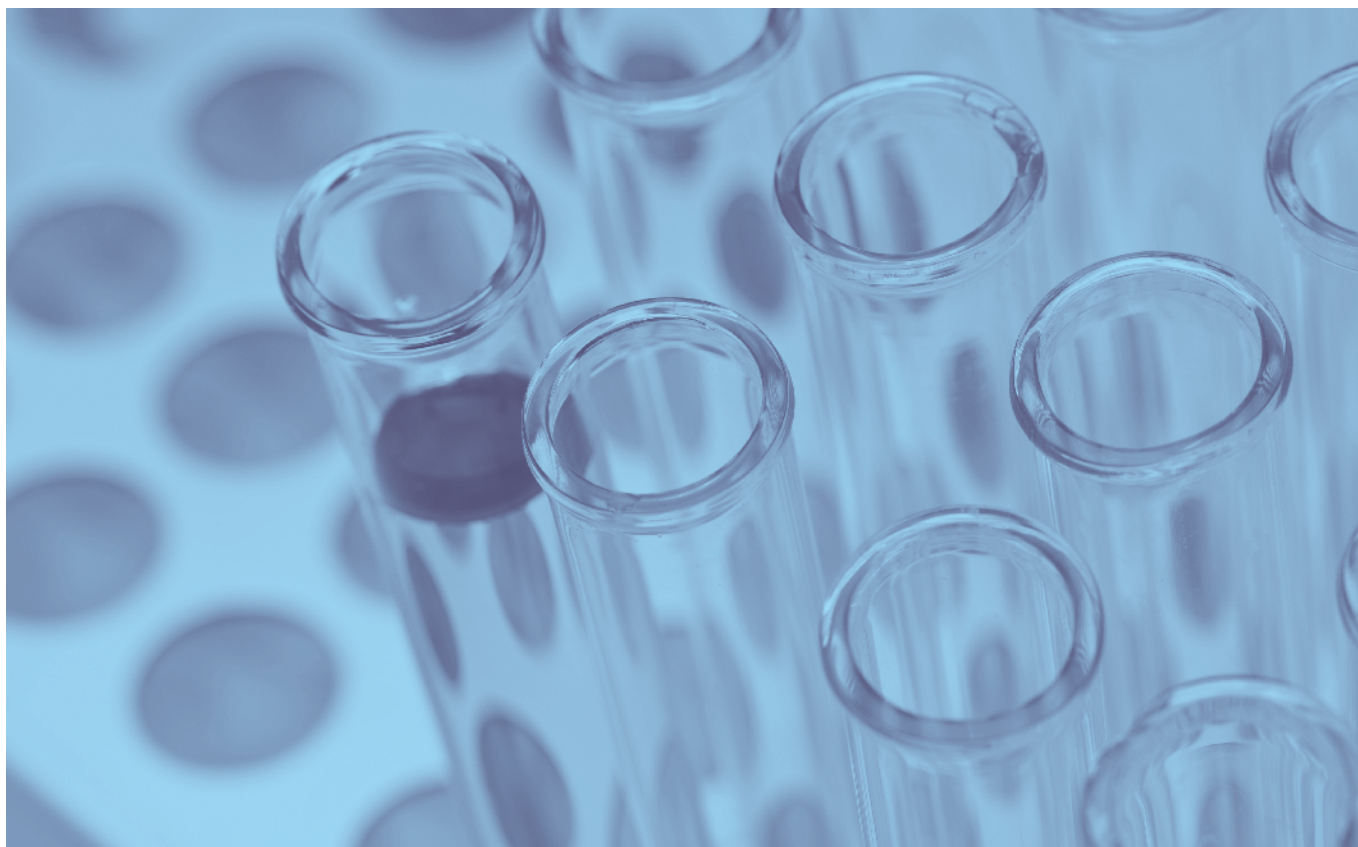
ExpediChem enables users to determine the HS code using the structure of a molecule. The system automatically applies the rules of Chapters 28 and 29 (including the named substances and various appendices, including the Pharmaceutical Appendix) with incredible accuracy.



The cloud-based platform can process hundreds of chemicals a minute, generating highly accurate HS codes and duty determinations for the US, UK, EU and China.



In tests, ExpediChem is faster, more accurate and cheaper than highly trained and experienced chemists.

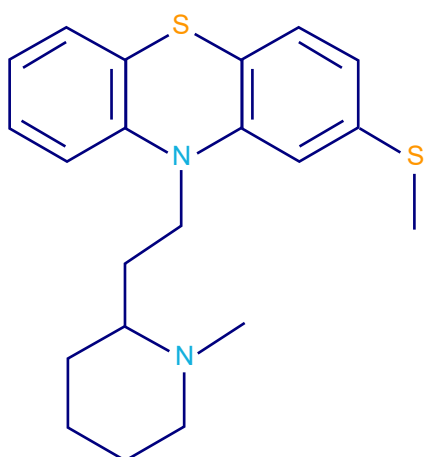




## Capturing context

An additional complexity of Chapter 29 is that results can be context-sensitive. For example, the HS code and duty can vary for the same structure depending on how it will be used, or even its biological activity.

Take the structure below:



This is thioridazine, an antipsychotic drug. Its HTSUS code, based purely on structure, is 2934.30.5000. However, since it shows drug-like activity – specifically central nervous system activity in the brain – there is a more appropriate code. It is impossible to derive the potential use or activity solely from a chemical structure. Instead, to arrive at the most accurate HS code determination, contextual information can also be provided and considered.

When using the ExpediChem platform, users are prompted for additional information where relevant. They're given a range of possible options to choose from to support the HS code designation process. If the user is not aware of any additional information, they can leave the section blank, and a HS code and appropriate duty

is calculated solely based on the chemical structure provided.

When context-specific information is provided, ExpediChem uses this to generate a more accurate HS code. In this case, ExpediChem has identified the most accurate HS code of 2934.30.2300 of the HTSUS (Drugs/Antidepressants, tranquilizers and other psychotherapeutic agents). While both results return the same 6-digit harmonized code, the extra context allows ExpediChem to arrive at a much more relevant 10-digit code.

# Making it simple for non-chemists

In many cases, those tasked with obtaining HS codes work within trade compliance or shipping groups and have limited chemical knowledge.

This can lead to incorrect HS codes being applied, a situation that can result in businesses paying excessive or inaccurate amounts of duty. It can also create unnecessary delays at customs. We recognise the challenges non-scientists face in generating HS codes, and have designed ExpediChem to be used by anyone – including those with no formal training or experience in the field. Using publicly available sources, users can search for over 250 million chemical names and identifiers within the system. Simply typing the first few characters of a substance name will display a list of options to choose from.

ExpediChem allows you to paste in or upload common chemical text-based formats such as SMILES and InChI strings, or utilise formats such as .mol and .sd to upload chemicals to check, even proprietary or novel ones. You can also use the chemical sketching tool to draw molecules, allowing proprietary chemicals to be assigned appropriate HS codes and duties.

With the Enterprise version of ExpediChem you can also search your own internal chemical inventories via your own catalogue and internal IDs, avoiding the need to draw or upload chemical structures at all. Furthermore, the Enterprise edition of ExpediChem allows assignments to be run through webservice integrations from within your existing applications.

We continue to invest in innovation, and in the future, we hope to allow users to directly upload images that have been cut and pasted from other sources, such as websites. ExpediChem will use image recognition to calculate the HS code automatically. You can search for a chemical compound by name and retrieve its chemical structure, its HS code and duty calculation in seconds.



“Easy searching via your own catalogue and compound IDs, structures and common chemical names”

The screenshot shows the ExpediChem web interface. It is divided into three main sections:

- 1: Select schedules**: A sidebar with a tree view of geographical regions including US Import, US Schedule B (export), European Union, China (PRC), United Kingdom, and Rest of World.
- 2: Input substances**: A search area with tabs for Substance Name, SMILES/InChI, Draw a Substance, and Upload a File. The 'Substance Name' tab is active, showing a search for 'aspirin' with a green checkmark. Below the search box is a list of 'Substances found by ExpediChem' with 'aspirin' selected. To the right, the 'Selected substance structure' is displayed as a chemical structure diagram.
- 3: Intended use and effect (optional)**: A table showing tariff information for aspirin.

input structure	Corporate ID	Country	tariff Code	Description	General Duty	special rate	rateZ	Comments
	aspirin	USHTS	2918.22.1000	- Carboxylic acids with additional oxygen function and their anhydrides, halides, peroxides and peroxyacids; their halogenated, sulfonated, nitrated or nitrosated derivatives; -- Carboxylic acids with phenol function but without other oxygen function, their anhydrides, halides, peroxides,	6.5%	Free(A*,AU,BH,CA,CL,C O,D,E,IL,JO,KR,MA,MX, OM,PPA,PE,S,SG)	15.4t/kg + 82%	
	aspirin	SCHB (US Export)	2918.22.0000	- Carboxylic acids with additional oxygen function and their anhydrides, halides, peroxides and peroxyacids; their halogenated, sulfonated, nitrated or nitrosated derivatives; -- Carboxylic acids with phenol function but without other oxygen function, their anhydrides, halides, peroxides,				

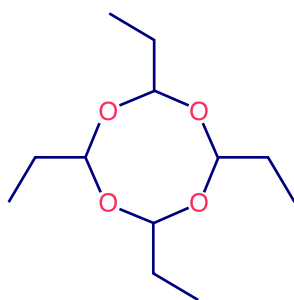
# Accuracy and speed

Identifying the correct HS code is critical, with an incorrect code potentially costing you tens of thousands of dollars in unnecessary duty payments.

ExpediChem is quick, and there are no compromises on accuracy. For example, where Chapter 29 specifies that all salts, ethers or esters of a product are to be considered, they are. The platform can also discriminate between different stereo forms of molecules when appropriate.

The system also accounts for extra chapter notes and explanatory notes, which can sometimes use definitions which may be counterintuitive to a trained chemist.

**Take this example:**



Initially, this appears to be O-heterocycle but is not classified here. If we refer to Chapter 29, Note 7, this compound is classified as a cyclic polymer of an aldehyde.

**Chapter 29, note 7 states:**

“Headings 2932, 2933 and 2934 do not include epoxides with a three-membered ring, ketone peroxides, cyclic polymers of aldehydes or of thioaldehydes, anhydrides of polybasic carboxylic acids, cyclic esters of polyhydric alcohols or phenols with polybasic acids, or imides of polybasic

acids. These provisions apply only when the ring-position hetero-atoms are those resulting solely from the cyclizing function or functions here listed.”

Even for a HS-trained chemist with years of experience, this complexity would be easy to miss. ExpediChem can manage this, achieving impressive levels of accuracy with the most challenging chemical compounds.

To test and validate the system, we processed a test-set of structures from the European Customs Inventory for Chemical Substances (ECICS), a publicly available database of manually assigned HS/CN numbers from the EU Taxation and Customs Directorate General.

During our tests, ExpediChem achieved 99% accuracy in generating HS codes against 14,055 chemicals in headings 2901-2935 inclusive (8-digit level comparison). Where there were differences, ExpediChem correctly classified chemicals more effectively than the ECICS.



“During tests, ExpediChem achieved 99% accuracy in generating HS codes against 14,055 chemicals previously coded by EU customs authorities”

Input Structure	Corporate ID	Country	Tariff Code	Description	General Duty	Special Rate	Rate2	Comments
	CCC1OC(CC)OC(CC)OC1	USHTS	2912.50.5000	- Aldehydes, whether or not with other oxygen function; cyclic polymers of aldehydes; paraformaldehyde; -- Cyclic polymers of aldehydes; --- Other	5.5%	Free(A,AU,BH,CA,CLC O,D,E,IL,JO,KR,L,MA,M X,OM,P,PA,PE,S,SG)	40%	*** 25% ADDITIONAL TARIFFS IF COO IS CHINA AND NO USTR EXEMPTION***



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# Solving the challenge of Chapter 29

The challenge of Chapter 29 has always been its complexity, depth and detail. Even experienced chemists rarely achieve more than 50% accuracy when given the task.

In many organisations, the job of obtaining a HS code is often given to trade compliance departments, which typically have little to no chemical knowledge. In these circumstances, errors aren't avoidable; they're inevitable.

Built by scientists, for both chemists and non-chemists, ExpediChem is a simple and easy-to-use web-based platform that can quickly and accurately achieve high-quality HS and duty determinations for commercial and proprietary chemicals. It can process large chemical libraries running into millions of substances while still delivering highly accurate results.

ExpediChem is a comprehensive rule-based computational system. There are no gaps in knowledge, personal preferences or subjectivity. Decisions are clear, consistent and non-subjective.

This intelligent and intuitive software can be used by anyone, without the need for detailed knowledge of HTS schedules. Its low-cost makes it an attractive tool for any chemical company. Codes can be generated automatically and validated manually for total confidence in their accuracy.

Chapter 28 and 29 coding errors have the potential to cost your business hundreds of thousands of dollars every year in unnecessary taxes and shipping delays.

ExpediChem is the fastest, cheapest and most accurate way to code chemicals and the single solution to the challenge of Chapters 28 and 29.



**“This intelligent and intuitive software can be used by anyone, without the need for detailed knowledge of HTS schedules”**



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# Business benefits

ExpediChem can help your business to save time and money by automating the HS code identification process. Here's how...



## Faster coding, bigger savings

In business, time is money. ExpediChem can provide a highly accurate HS / commodity code in seconds, as opposed to hours, days or weeks. This can generate significant process and efficiency savings.



## Cutting consultant costs

A subscription to ExpediChem is much cheaper than trade compliance lawyers or chemical consultants who can charge up to \$800 per hour. Automated HS coding enables you to use your business's resources more effectively by working more efficiently.



## Tackling taxes

ExpediChem can have a dramatic impact on your tax liability, potentially saving you tens of thousands of dollars every year.

### EXAMPLE ONE

Here's an example of how ExpediChem can help you save money. A company has a shipment of 500 chemicals with a value of \$250,000 to export. They're unable to manually code this amount of chemicals in a reasonable timeframe so declare them with a general chemicals HS code with the highest duty rate of 6.5% to prevent the risk of accidental tax fraud.

In this case, the total duty to be paid is \$16,250.

Using ExpediChem, the business can generate accurate HS codes, which reflect the exact liability due – which in many cases, is much lower. In this example, the exact duty is \$13,812.

## A saving of \$2,438 for a single shipment.

### EXAMPLE TWO

In another example, four proprietary compounds were custom synthesised and shipped to a customer on the gram scale for \$142,000. The duty was manually determined by the synthesising chemist to be 4.8% based on the structures of the compounds. However, the chemist had missed some essential parts buried in the hundreds of pages of HS regulations, additional explanatory notes and country-specific rules which accurately classified the duty rate as 0%.

## Scitegrity's ExpediChem platform saved \$6,815 for a single shipment.

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# About Scitegrity

For more information on ExpediChem,  
[visit www.scitegrity.com](http://www.scitegrity.com)

Founded in 2011 by former pharmaceutical scientists, chemists and data managers, Scitegrity specialises in allowing the searching of chemical regulations.

Our software solutions are relied on by dozens of chemical and pharmaceutical companies, CROs and regulators globally, including half of the world's top-10 pharmaceutical companies.

Scitegrity also provides other related chemical legislation compliance services, such as Controlled Substances Squared for the automatic identification of controlled and regulated substances including Ozone Depleting, Controlled Drugs, Chemical Weapons, Military Dual-Use Lists, ITAR, CCL and other chemical regulations.



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# System coverage and limitations

We are developing the capacity and potential for ExpediChem all the time, adding new functionality and improvements to the system.

ExpediChem covers Chapters 28 (inorganic) and 29 (organic chemicals) of the HTS US, Schedule B, UK, EU and Chinese tariff schedules and includes the Pharmaceutical Appendix and the Chemical Appendix (applicable to the US only). However, it does not handle composites, polymers or biologics (which are not part of Chapters 28 or 29).

Some Chapter 29 sub-headings use vague and ill-defined terminology. For example, sub-heading 2937 (provitamins, vitamins and hormones) carries a note relating to hormones which reads:

"...hormone derivatives and structural analogues used primarily for their hormonal effect, but also to those derivatives and structural analogues used primarily as intermediates in the synthesis of products of this heading".

Derivatives and analogues are nebulous terms with no clear or agreed chemical boundaries or definitions. This is a problem for both manual and automated assessments. For these areas, if the user indicates it's a hormone, the system will attempt to use substructure and similarity searching to determine if the substance is similar to any of the hormone classes listed in the chapter sub-headings.

The final limitation is the 'essential character' problem of the product. Take, for example, acetic acid (more widely known as the main ingredient of vinegar). This is classified as 2915 within Chapter 29. However, if it is below 10% by weight in solution, it is better placed under Chapter 22 – Beverages, Spirits and Vinegar, as its 'essential character' is that of table vinegar.

Despite these limitations, for the vast majority of organic chemicals, ExpediChem can achieve highly accurate determinations.



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## Endnotes

- 1 Evaluation of the European Customs Inventory of Chemical Substance (ECICS). <https://op.europa.eu/en/publication-detail/-/publication/cfc3556a-e46e-11e7-9749-01aa75ed71a1/language-en/format-PDF/source-55745419>.
- 2 ECICS ([https://ec.europa.eu/taxation\\_customs/dds2/ecics/chemicalsubstance\\_consultation.jsp?Lang=en](https://ec.europa.eu/taxation_customs/dds2/ecics/chemicalsubstance_consultation.jsp?Lang=en)) The European Customs Inventory for Chemical Substances (ECICS), a publicly available database of non-binding, manually assigned HS/CN number from the EU Taxation and Customs Directorate General.
- 3 Pubchem (<https://pubchem.ncbi.nlm.nih.gov/>) is a publicly available database of chemicals maintained by the National Institutes of Health.
- 4 CROSS (<https://rulings.cbp.gov/home>). Allows a text-based search for US Customs rulings (all chapters) and submission of specific queries.

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