ECHA Public consultation – Ethanol

Estonian Chemical Industry Association (Eesti Keemiatööstuse Liit) is an organization representing Estonian chemical companies in the entire value chain – substance manufactures, mixture formulators and distributers in the fields of detergents, disinfectants, biocides, household products, paints, solvents, cosmetics etc. Ethanol is an essential ingredient used by our member companies in a broad range of household, professional and industrial products. In addition to its indispensable use as an active substance in disinfectants and as a co-formulant in insecticides and repellents, it is also important in cleaning products such as hand dish washing liquids, laundry detergents, surface cleaners, windshield washer fluid and also in fragrance products such as perfumes, reed diffusers and other cosmetics.

Ethanol is crucial to our sector and viable alternatives do not exist

Ethanol shows a unique combination of rapid, broad-spectrum antimicrobial activity and a favorable exposure profile in PT1, PT2 and PT4 formulations that is unmatched by available alternatives. It has a broad-spectrum efficacy against bacteria, fungi, and both enveloped and non-enveloped viruses, and this within very short contact times. Its use in biocidal applications, whether as a hand disinfectant or a surface disinfectant—is essential for maintaining public health, particularly in high-risk environments. Reclassification that compromises these applications would jeopardize effective infection control and could lead to significant safety and supply challenges.

In fact, Ethanol is critical for human health and safety. More than 3.5 million cases of HealthCare Associated Infections (HCAI) are estimated to occur in the EU/EEA each year, leading to more than 90 thousand deaths. Ethanol is endorsed by the WHO. It is known to be the most effective substance in the fight against HCAIs and the only substance effective against viruses like polio.

Ethanol is a vital ingredient in various cleaning and household products, such as surface disinfectants and skin repellents. Restaurants and food industry use ethanol-based products to prevent the spread of salmonella, ensuring food safety and public health. It is also a skin repellent essential since vector borne diseases are rising due to climate change in Europe.

Ethanol is essential not only for its strong disinfectant action, but also for being the most used solvent in the formulation of all product categories. When used as a co-formulant in insecticides and repellents, ethanol presents un-matched solvency properties, helps control viscosity and is highly compatibility with the other formulation's ingredients.

The solvency property of ethanol is in fact unique: non-soluble in water active ingredients dissolve easily and are extremely stable during the shelf life and as soon as the product is applied to a surface the solvent evaporates, and only the benefits of the active ingredient remain. This characteristic leads the substance to be used widely. Ethanol is commonly present in the formulation of all those products that require rapid evaporation of the solvent after application, such as skin repellents (PT19), ready-to-use insecticides (PT18) or perfumes (contained in most of consumer products).

There are also no alternatives in the pharmaceutical and food industries, and in the production of flavours and fragrances, where ethanol is used to extract active ingredients of natural origin.

Alternative considerations

Across many critical use cases, viable substitutes for ethanol are either non-existent or significantly less effective, both in terms of efficacy and overall safety.

With regards to healthcare-associated infections (HCAIs), no alternative biocidal active substance provides comparable effectiveness against non-enveloped viruses such as poliovirus, adenoviruses, and noroviruses. These pathogens are particularly resilient and non-enveloped viruses remain among the most difficult to inactivate. Ethanol's proven rapid action against this group of viruses remains unmatched, making it indispensable for infection prevention strategies in healthcare environments.

For point-of-care hand hygiene, no other substance matches ethanol's unique combination of broad-spectrum efficacy, rapid antimicrobial action, excellent skin tolerability, and minimal irritation profile. Other alcohols, such as propanols, while partially effective against certain pathogens, evaporate more slowly, increase skin exposure times, and are associated with greater dermal irritation and drying effects. Non-alcohol alternatives like chlorhexidine, hydrogen peroxide, or quaternary ammonium compounds (QACs) lack either the rapid virucidal activity or the broad pathogen spectrum required for effective hand hygiene — and many pose additional sensitisation or residue issues. Given that healthcare workers apply hand sanitisers between 60 to 100 times per day, ensuring skin compatibility is not merely a

comfort factor, but a necessity for maintaining compliance with hygiene protocols and protecting skin health over time.

The absence of an effective substitute for ethanol would likely lead to a sharp increase in infection rates, both in healthcare facilities and in public settings. Higher infection rates would, in turn, result in substantially increased healthcare costs due to longer hospital stays, additional treatments, workforce absenteeism, and broader public health impacts.

Some alternative substances might warrant limited consideration under specific conditions for different PTs: propanols, oxidising agents like peracetic acid, chlorine compounds and hydrogen peroxide, lactic acid, Quaternary Ammonium Compounds.

Ultimately, while a few alternative substances could theoretically serve in niche scenarios, none possesses the combination of immediate virucidal efficacy, operational practicality, skin safety, regulatory acceptance, and public trust that ethanol-based formulations uniquely provide. Ethanol remains irreplaceable as the cornerstone of effective human hygiene and infection prevention strategies across healthcare, food industry, and public environments.

Economic feasibility

Ethanol production is highly cost-competitive due to optimized production processes and economies of scale that significantly lower its manufacturing costs compared to alternative disinfectants. Propan-1-ol and propan-2-ol are significantly more expensive than ethanol. Their higher production costs, coupled with their narrower spectrum of action (ineffective against nonenveloped viruses), result in additional costs for supplementary disinfectants in healthcare settings. The longer contact times required for effective disinfection with these substances also contribute to their reduced cost-effectiveness, as larger quantities are needed for equivalent results.

In addition to its technical superiority, ethanol also offers significant economic advantages over alternative disinfectants. While some alternative substances, such as propanols or oxidising agents like peracetic acid and chlorine compounds, may initially appear competitive in unit cost, their overall application costs are considerably higher. These alternatives often require longer contact times, greater product volumes, specialised application protocols, additional personal protective equipment, or post-application rinsing, all of which increase operational expenses. Furthermore, the use of harsher disinfectants may lead to material degradation or corrosion of sensitive surfaces and equipment, resulting in additional maintenance and replacement costs. In contrast, ethanol's rapid evaporation,

broad material compatibility, minimal residue, and well-established public and regulatory acceptance ensure not only effective disinfection but also lower total costs across healthcare, food production, and public hygiene environments. Therefore, beyond its unmatched efficacy and safety, ethanol remains the most economically viable choice for widespread disinfection applications.

Hazards and risks

The assessment of the CMR toxicity of ethanol is based on experience from the misuse of alcoholic beverages, i.e. exclusively on oral intake. When used as a chemical, this is not relevant and does not play a role in occupational hazards, so these data are not suitable for classification as an industrial chemical or in consumer products. Typically, ethanol is used in the chemical industry in denatured form to prevent oral uptake. Making regulatory decisions based on extrapolations from studies —— which are unlikely to be realistic considering the actual use of a substance —— to real-world scenarios, does not seem reasonable. If the purpose of the hazard identification and risk problem formulation questions is to understand the human health effects associated with chronic high-dose ethanol consumption, then such toxicity testing would indeed be appropriate. Conversely, if the purpose of the hazard identification and risk problem formulation is to address much lower exposures to ethanol in occupational and other environmental scenarios, then chronic toxicity testing based on very high doses is clearly not appropriate (Principles of dose-setting in toxicology studies: the importance of kinetics for ensuring human safety).

When considering alternatives to ethanol-based disinfectants, propanols (such as isopropanol and n-propanol) are often cited as the primary potential substitutes. However, a closer examination reveals that the scientific basis for comparing ethanol's carcinogenicity, mutagenicity, and reproductive toxicity (CMR) potential to that of propanols is neither proportional nor scientifically justified.

The REACH registration dossiers available through ECHA's chemical database (ECHA CHEM) indicate that for propanols, only a limited number of studies exist addressing the carcinogenicity endpoint. Moreover, these studies are largely based on dermal and inhalation exposure routes at doses typical for classical chemical testing protocols. Importantly, no substantial human epidemiological data are available to support or contextualize the findings for propanols.

In contrast, ethanol has been subjected to an exceptionally extensive and rigorous body of research. Its CMR classification debates are predominantly informed by high-dose oral exposure studies — reflecting alcohol consumption levels far exceeding any conceivable

exposure from its use in disinfectants. Furthermore, there is a substantial body of human epidemiological data, largely derived from decades of public health research into alcohol consumption, that informs ethanol's toxicological profile. This human data includes known confounding factors such as lifestyle, co-exposures, and comorbidities, which are absent from standard chemical risk assessments for other substances.

Thus, ethanol's hazard profile, particularly its CMR concerns, is based on high-dose systemic oral exposure and chronic abuse, not on dermal or inhalation exposure at the levels relevant to its use in biocidal products. This contrasts sharply with the typical datasets available for other chemical substances. A proportional, scientifically sound risk comparison must consider the nature, quality, and relevance of the available data — not merely the formal existence of studies.

Given that biocidal use of ethanol predominantly involves dermal exposure and inhalation of low vapour concentrations during brief applications, the extrapolation of high-dose oral ingestion data to these exposure scenarios is scientifically inappropriate. Conversely, the lack of comprehensive human-relevant data for other substances might leave significant uncertainty about their true long-term safety profile when used intensively, especially under the high-frequency hand hygiene protocols demanded in healthcare and food environments.

Accordingly, any regulatory treatment that penalizes ethanol based on high-dose oral ingestion risks, while not treating other substances comparatively, constitutes a disproportionate and inconsistent application of scientific principles. A fair and scientifically justified regulatory assessment must weigh both the quality and relevance of the underlying evidence, including the realistic routes and levels of exposure in intended uses.

In light of these considerations, ethanol remains the better-characterised, better-understood, and thus more reliably manageable active substance for widespread human hygiene applications, including hand disinfection.

In addition, ethanol is safe for the environment: it mainly comes from renewable sources, it is fully biodegradable compared to its alternatives, it leaves no residue on surfaces, it evaporates quickly, and it is generally more sustainable than other options.

Availability

Ethanol benefits from a well-established supply chain with a robust network of suppliers across the EU. Additionally, ethanol production is more adaptable to demand surges, allowing for quicker scaling compared to the production of propan-1-ol or propan-2-ol, which was convincingly demonstrated during the COVID-19 pandemic. This makes ethanol not only

more available but also a more reliable and practical option for meeting high-demand needs in critical sectors like healthcare.

Ethanol was critical in combating COVID-19: it was widely available and cost-effective, unlike propanol and other alternatives. The industry was able to ramp up production and meet government requirements.

In a world of geopolitical uncertainty and climate related disasters, ethanol-based hand disinfectants are a key tool in preventing the spread of disease in war torn and disaster areas, refugee camps and during rural outbreaks of deadly viruses such as Ebola when water and proper handwashing is inaccessible.

Regulatory considerations

The EU should move towards a more risk-based approach rather than a hazard-based approach in chemicals management. Europe places too much emphasis on hazards as the main driver for decision-making, to the point where it is questionable whether certain decisions are based on balanced and consistent scientific assessments. The competent body for the classification of substances is primarily the European Chemicals Agency's Committee for Risk Assessment (RAC), which is responsible for the harmonised classification and labelling process under the CLP Regulation. To avoid unnecessary confusion, ethanol should be allowed to complete its CLP process before its approval process under the BPR takes place. Therefore, we call for the current biocidal process to be concluded without reclassification or postponed until complete socio-economic assessment is conducted and the need for refined harmonized C&L for ethanol is properly assessed.

Summary

The use of ethanol as a disinfectant, as an industrial chemical and as part of consumer products is essential, safe and must be preserved!

Annex I

Additional information on the de facto ban

Ethanol’s reclassification means a de facto ban and would have massive consequences not only on European industry, but also on society as a whole, while not bringing any benefit to human health or the environment.

The evaluation of the CMR endpoints and a subsequent decision on these endpoints by the BP Committee and European Commission would result in official statement on the CMR properties of Ethanol for Biocidal Uses. This available information would have to be taken into account by all users of Ethanol during their **self-classification process**. Thus, a classification within the Biocide sector would be transferred into all sectors. Additionally, this official position on the CMR properties could influence the opinion-forming process of other CLP committees and thus affect the currently ongoing harmonised classification process.

For a substance meeting the criteria for carcinogenicity, regulatory obligations apply under the following regulations and directives (and there are more in the pipeline) - source: Fulfilling the criteria for CLP classification: the implications for substances under the EU chemicals legislation; Diana Kättström, Anna Beronius et al

- Substances meeting the criteria for carcinogenicity may be added to Annex XIV of the REACH Regulation, which lists substances requiring **authorisation** (Article 57). Entries 28–30 of Annex XVII of the REACH Regulation impose a **ban on the sale to the general public** of substances classified as Category 1A or 1B carcinogenic, mutagenic, or toxic to reproduction, as well as mixtures containing such substances above a specified concentration limit (**generally 0.1%**).
  In addition, the placing on the market of tattoo inks containing Category 1A, 1B, or 2 carcinogens is restricted (Annex XVII entry 75).
- Under the Biocidal Products Regulation and the Plant Protection Products Regulation, active substances classified as Category 1A or 1B carcinogens are **generally not approved as active substances** [Biocidal Products Regulation Article 5(1), Plant Protection Products Regulation Annex II point 3.6.3].
  However, under certain circumstances and for a limited time, they may be approved as candidates for substitution [Biocidal Products Regulation Article 10(4), Plant Protection Products Regulation Article 24(1)].
  For such substances, the Biocidal Products Regulation limits approval to a maximum of five years [Article 4(1)], and the Plant Protection Products Regulation to a maximum of seven years [Article 24(1)].
  Biocidal products containing candidate substances must not be made available to the general public [Article 19(4)].
- According to the Prior Informed Consent (PIC) Regulation, the export of substances subject to the PIC procedure is prohibited if they are classified as Category 1A or 1B carcinogens [Article 14(7)].

- For industrial installations, the Industrial Emissions Directive requires the **substitution of classified carcinogens** with less hazardous substances as soon as possible (Article 58).
- To protect workers, the Carcinogens and Mutagens Directive imposes obligations on employers to assess exposure to carcinogens, **reduce the use of such substances, prevent exposure risks, and take necessary precautionary measures** [Article 3(2), Article 4(1), Article 5].
  Employers must also monitor workers' health, keep health records for at least 40 years, and notify the competent authority of any cancer cases arising from exposure to carcinogens [Articles 6, 10(1), 11, 14–16, 18].
- Similarly, the Chemical Agents Directive aims to protect workers' health by requiring employers to assess the presence of hazardous substances and the risks to health, and to implement preventive measures [Article 3(1), Article 4(1)].
  Employers must make information available about hazardous substances, such as safety data sheets, and any necessary precautions or emergency procedures (Articles 7, 8, 10).
- The Young Workers Directive prohibits employing workers under the age of 18 in jobs involving substances meeting any category of carcinogenicity criteria [Annex, entry 3(a)].
- The Pregnant and Breastfeeding Workers Directive requires employers to **assess the exposure of pregnant women, women who have recently given birth, or breastfeeding workers to any category of carcinogens, and to take measures to mitigate risks** [Annex I, entry 3(a)].
- Under the Regulation on Active and Intelligent Materials and Articles Intended to Come into Contact with Food, carcinogenic substances must not be used in material components designed to prolong shelf life or monitor food condition, even if not in direct contact with food [Article 5(c)].
- The Plastics and Materials Regulation restricts the use of carcinogens in multilayer plastic materials and articles made from different materials, even when there is no direct food contact (Articles 13, 14).
- Substances classified as Category 1A or 1B carcinogens are **prohibited in cosmetic products** under the Cosmetics Regulation.
  Category 2 carcinogens are also prohibited unless an expert committee has assessed and deemed them safe (Article 15).
- The In Vitro Diagnostic Medical Devices Regulation and the Medical Devices Regulation require that in vitro and medical devices be designed and manufactured

so that levels of harmonised classified carcinogens are as low as possible (Annex I, entry 10).
Additionally, the Medical Devices Regulation requires information about precautions related to the presence of carcinogens to be included in instructions provided to users/patients (Annex I, Chapters II and III).

- The Toy Safety Directive prohibits the use of any substances classified as carcinogenic of any category in toys, toy parts, or components (Annex II, Chapter III, entry 3).

PT1 – Human hygiene biocidal products: Hygienic and surgical hand disinfection by hand rubbing without rinsing

There is currently no alternative biocidal active substance that can match ethanol's rapid and broad-spectrum effectiveness against non-enveloped viruses, such as norovirus, adenoviruses, enteroviruses (for which no vaccines are available) and poliovirus, as well as enveloped viruses like SARS-CoV-2. Given the rising prevalence of viruses like norovirus, responsible for millions of cases of gastroenteritis annually, and the re-emergence of poliovirus, it is imperative that Europe maintains robust preventive measures. Ethanol-based hand rubs remain unparalleled in their ability to combat these viruses effectively and are vital for protecting public health.

Ethanol demonstrates the ability to inactivate a wide range of pathogens within seconds, significantly reducing contact times and product usage, thus enhancing workflow efficiency in critical environments such as healthcare facilities. Its rapid action is especially crucial in emergency and high-traffic settings, where swift hand disinfection is required to prevent cross-contamination and maintain patient safety. Furthermore, ethanol remains effective even in the presence of organic material, such as blood or other bodily fluids, unlike many other disinfectants whose efficacy is compromised under such conditions. This robustness makes ethanol highly reliable for both routine and emergency hygiene procedures.

Moreover, no substitute offers ethanol's exceptional skin tolerability, which is vital for maintaining high compliance among healthcare workers and the general public. Alternatives such as propanols evaporate more slowly, thereby increasing dermal exposure and raising the risk of skin irritation or dermatitis, particularly with frequent use. In contrast, ethanol's rapid evaporation minimises contact time, significantly reducing the likelihood of skin reactions. Compared to other biocidal agents, ethanol also has a notably lower sensitisation

potential, making it better suited for repeated daily application by individuals with sensitive skin.

In addition to its excellent skin tolerability, ethanol-based hand sanitisers offer superior cosmetic acceptability, as they leave minimal residue and do not cause stickiness or unpleasant odours after application. This increases user satisfaction and promotes regular use, a key factor in maintaining effective hygiene standards.

Ethanol-based hand sanitisers are indispensable tools for infection prevention and control, both in clinical environments and in everyday life. The World Health Organization (WHO) has recognised the critical importance of these products by including ethanol-based hand rubs in its Essential Medicines List. Restricting the availability or use of ethanol-based hand sanitisers would significantly endanger public health and weaken established infection control practices across Europe.

Evidence from the WHO shows that campaigns promoting hand hygiene with ethanol-based sanitisers have led to a 50% reduction in healthcare-associated infections (HCAIs) across Europe over the past decade. Nevertheless, HCAIs continue to cause over 4.3 million cases each year in the European Union and European Economic Area (EU/EEA), leading to approximately 37,000 directly attributable deaths, 16 million additional hospital days, and contributing to between 90,000 and 110,000 deaths annually. Should ethanol be classified as a carcinogenic, mutagenic, or toxic for reproduction (CMR) substance, its prohibition in hospitals could reverse this progress and potentially double the current rate of healthcare-associated infections.

Beyond the healthcare setting, ethanol-based hand rubs play a crucial role in public health protection during outbreaks and pandemics, where fast, effective, and widely available disinfection options are essential. Ethanol's broad acceptability, biodegradability into non-toxic byproducts (water and carbon dioxide), and resilience during supply chain disruptions further strengthen its strategic importance as the cornerstone of human hygiene biocidal products.

In conclusion, ethanol’s unique combination of fast action, broad efficacy, excellent skin compatibility, user acceptability, environmental safety, and proven impact on public health outcomes establishes it as an irreplaceable active substance in hand disinfection. No current alternative matches the comprehensive benefits ethanol provides in safeguarding health in clinical, occupational, and everyday environments.

PT2 - Private area and public health area disinfectant

When considering PT2 applications, particularly in environments with frequently touched surfaces such as hospitals (including the disinfection of furniture, walls, and floors), industrial settings, educational institutions, and childcare facilities, it becomes evident that no other PT2 active substance offers a viable alternative to ethanol when evaluated against its combined advantages. Ethanol uniquely provides a comprehensive efficacy spectrum, rapid antimicrobial action, compatibility with various surfaces, and an excellent safety profile, setting it apart from other available substances.

Other alcohols, such as propanols, exhibit limited virucidal activity compared to ethanol, particularly against non-enveloped viruses. Oxidising agents like peracetic acid, while offering a broader efficacy spectrum, present significant drawbacks: peracetic acid is corrosive, necessitating the use of personal protective equipment (PPE) and restricting its use due to material incompatibility. This limitation is particularly critical in healthcare settings, where the disinfection of sensitive materials, such as medical equipment surfaces, must not compromise material integrity through corrosion or degradation.

In addition to its broad-spectrum antimicrobial action, ethanol offers several practical advantages that are critical for effective hygiene management. Its rapid evaporation rate eliminates the need for wiping down surfaces post-application, ensuring quick turnaround times in busy environments and reducing the risk of cross-contamination. Unlike many oxidising disinfectants, ethanol does not corrode metals or damage sensitive electronic equipment, making it ideal for use in settings that rely heavily on medical devices, laboratory instruments, and digital technology.

Ethanol's effectiveness is also maintained across a broad range of temperatures, whereas some disinfectants lose efficacy under varying environmental conditions. Furthermore, its relatively low toxicity and high compatibility with human skin compared to other chemical agents ensure better alignment with personal safety standards, particularly in environments where frequent human contact is unavoidable.

Ethanol delivers broad-spectrum disinfection that is essential for maintaining health and safety standards. It is well-recognised for its ability to eliminate a wide array of microorganisms, including bacteria, viruses, and fungi. The inclusion of ethanol in multi-purpose cleaning products ensures both effective cleaning and disinfection, providing comprehensive hygiene benefits within a single formulation.

Many public health agencies and environmental authorities acknowledge ethanol as a safe and effective ingredient in cleaning products. Maintaining ethanol’s role in multi-purpose cleaners ensures compliance with recognised standards and sustains market acceptance

across various regions. Notably, the European Centre for Disease Prevention and Control has emphasised the importance of using ethanol-based cleaning products in the fight against coronaviruses.

Ethanol also possesses critical solvent properties essential for cleaning products. It effectively dissolves dirt, grease, and organic matter on a variety of surfaces, making it indispensable in multi-purpose cleaners designed for demanding environments such as kitchens, bathrooms, and heavily trafficked areas. Importantly, ethanol breaks down into non-toxic by-products, namely water and carbon dioxide, leaving minimal residue, and making it safe for use on surfaces that come into contact with food.

Compared to many other chemical disinfectants, ethanol presents a lower risk of causing skin irritation or allergic reactions when used as directed. This characteristic makes ethanol-based products particularly suitable for household use by a wide range of consumers, including those with sensitive skin. In addition, ethanol enjoys strong public trust, with consumers recognising its safety and effectiveness, which fosters higher compliance with hygiene recommendations.

There is also a distinct lack of alternative substances capable of being safely and effectively used on such a wide range of surfaces. Ethanol, at a 70% concentration, achieves effective disinfection without causing surface damage, making it suitable even for sensitive materials. In contrast, substances like sodium hypochlorite, although effective as disinfectants, tend to corrode or discolour various materials, significantly limiting their applicability.

Finally, ethanol presents fewer environmental concerns compared to many chemical alternatives. Thanks to its rapid biodegradation into harmless components, ethanol offers a lower ecological footprint, reinforcing its role as an environmentally responsible choice for sustainable hygiene practices.

In light of these comprehensive advantages, ethanol remains an indispensable active substance in surface disinfectants, crucial to public health, occupational safety, and environmental sustainability.

PT4 - Food and feed area disinfectant

The use of PT4 disinfectants is indispensable for maintaining the highest hygiene standards within the food and feed sectors. Among the available active substances, none offer a suitable alternative to ethanol when considering the combination of its broad efficacy spectrum, rapid antimicrobial action, excellent safety profile, rapid evaporation, and

regulatory acceptance for use on food contact surfaces. Ethanol's unique properties distinguish it clearly from all other available substances.

Alternative disinfectants demonstrate notably limited virucidal activity compared to ethanol, particularly against non-enveloped viruses, which represent a significant challenge in food hygiene. Moreover, no available substitute matches ethanol's rapid evaporation profile. Substances such as propanols evaporate significantly more slowly, resulting in prolonged surface contact times—an undesirable feature in food and feed environments where surfaces must be rapidly disinfected and quickly returned to use to maintain uninterrupted operations.

Restricting the use of ethanol-based disinfectants would pose a serious risk to food safety. Ethanol-based hand hygiene interventions are essential at the farm level, particularly in harvest areas where access to water and traditional handwashing facilities is limited. In such settings, ethanol-based products are critical to preventing the transfer of human-borne viral and bacterial pathogens, including Hepatitis A, Norovirus, and Salmonella, to ready-to-eat foods such as salads and berries.

Throughout the food supply chain—from farms to distribution centres, processing facilities, retail outlets, and ultimately to consumers' tables—ethanol-based disinfectants play a crucial role in preventing cross-contamination. Their application at critical control points ensures that the integrity and safety of food products are preserved during every stage of handling, processing, and distribution.

Within the food processing industry, ethanol is widely relied upon to minimise the risk of foodborne contamination. Its role is particularly vital in low-moisture food production, where it serves as the preferred surface disinfectant for facilities manufacturing highly sensitive products such as infant formula, dried dairy products, nuts, and cereals. Ethanol's advantage lies in its ability to maintain a dry cleaning cycle, which is essential to prevent the growth of pathogens such as Cronobacter sakazakii, E. coli, and Salmonella, while eliminating the risk of introducing moisture into sensitive production environments.

In supermarkets, restaurants, and foodservice establishments of all sizes, ethanol-based disinfectants offer a fast and effective method for ensuring the hygiene of food contact surfaces in kitchens, deli counters, and meat preparation areas. Furthermore, their use extends to public areas, enabling the efficient disinfection of shopping trolley handles, cash register conveyors, and restroom facilities, thereby safeguarding both food handling environments and public health.

Ethanol's unparalleled suitability for food and feed settings is further evidenced by its regulatory acceptance for use on food contact surfaces without requiring post-application rinsing. In contrast, many alternative disinfectants necessitate rinsing, adding operational complexity and increasing water consumption. Additionally, ethanol evaporates cleanly without leaving residues that could affect the taste, smell, or appearance of food, preserving the sensory qualities essential to consumer trust and satisfaction.

Its rapid drying time is critical for maintaining operational efficiency, allowing food production and retail facilities to resume normal activities almost immediately after disinfection. Ethanol also poses minimal risk of harmful chemical residues, decomposing into harmless by-products such as water and carbon dioxide, in stark contrast to alternative disinfectants that may leave persistent and potentially harmful residues.

Ethanol maintains its efficacy even in the presence of organic matter—such as blood, fats, or food debris—conditions where many oxidising agents lose their effectiveness. Its compatibility with a wide range of surfaces, including stainless steel, plastics, and delicate materials, without causing corrosion or degradation, reduces the need for multiple types of disinfectants across different settings, thereby simplifying hygiene management.

Moreover, ethanol enjoys high levels of public trust and acceptance due to its widespread familiarity in products such as alcoholic beverages and sanitisers. This consumer confidence supports compliance with hygiene practices across the food and feed sectors. Its widespread local production from renewable sources further enhances supply chain resilience and contributes to environmental sustainability, aligning with the goals of the EU Green Deal and the broader transition to greener, circular economies.

In light of these numerous advantages, ethanol remains a cornerstone of safe, effective, and sustainable hygiene practices throughout the food and feed production and distribution chain. No other substance matches its unique combination of efficacy, safety, operational practicality, environmental responsibility, and regulatory acceptance.